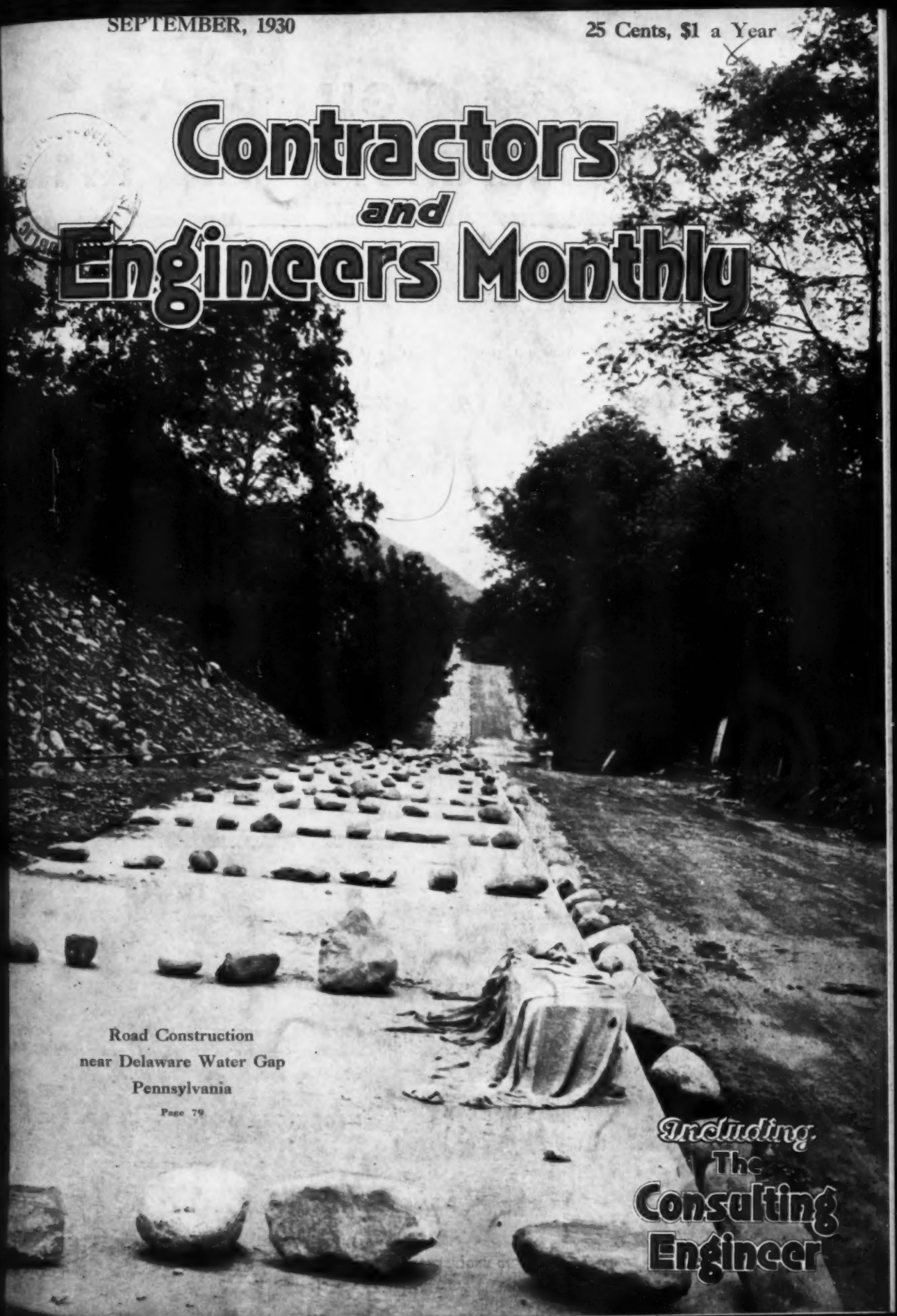
SEPTEMBER, 1930

25 Cents, $1 a Year

# Contractors and Engineers Monthly

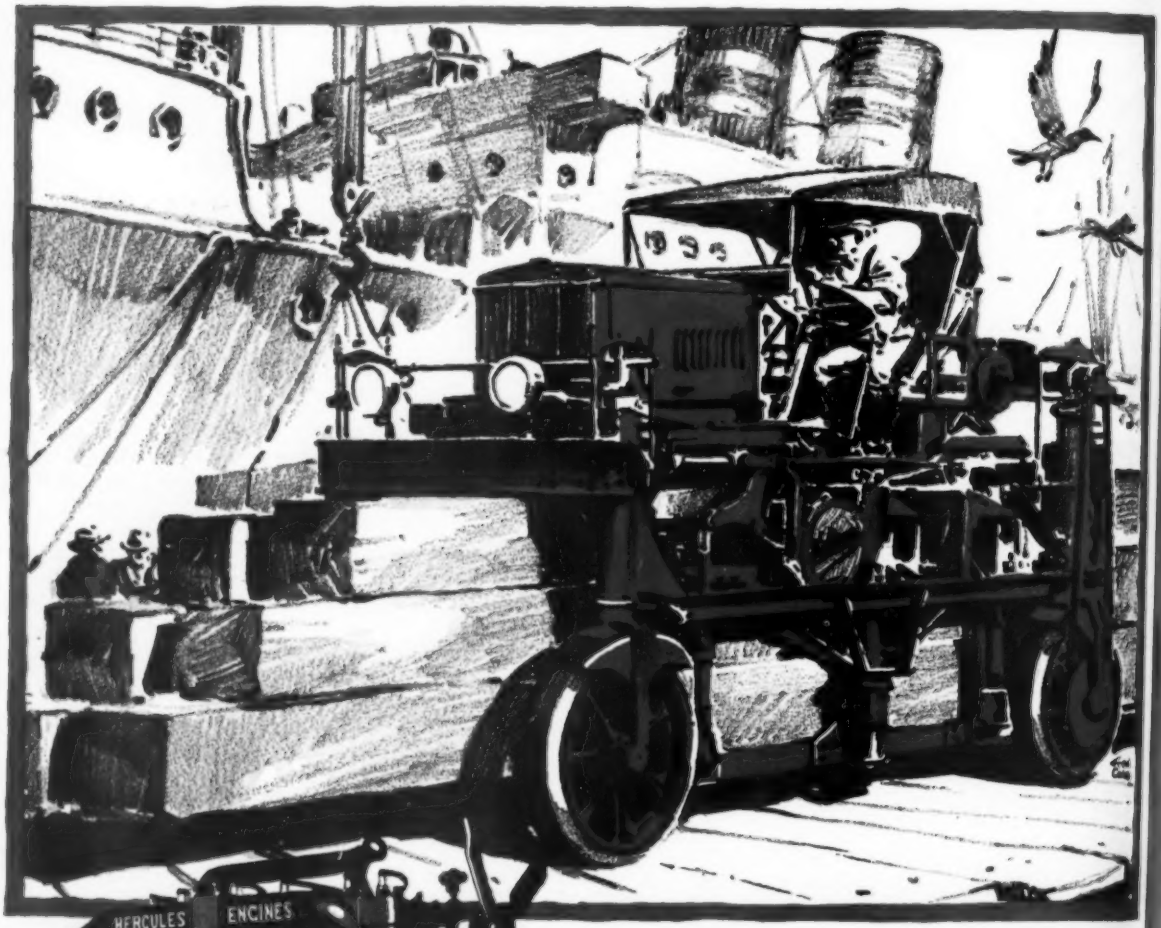


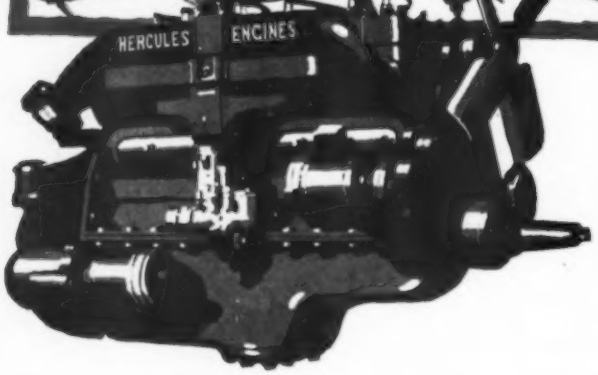
Road Construction
near Delaware Water Gap
Pennsylvania

Page 79

Including
The
Consulting
Engineer

# HERCULES ENGINES POWER THE WILLAMETTE CARRIER



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Vol. XXI No. 3 CONTRACTORS AND ENGINEERS MONTHLY, SEPTEMBER, 1930 Price, 25 Cents; $1 a Year
Entered as second-class matter, April 16, 1923, at the Post Office at New York, N. Y., under Act of March 3, 1879. Issued Monthly by
The Buttenheim-Dix Publishing Corp., 470 Fourth Ave., New York. Printed in U. S. A.

# Labor Savers

## *are also*

# Cost Cutters

## *on a*

# Viaduct *and* Bridge Job

***Form Work Made Easier to Handle***

***and***

***Concrete Buggying Costs Reduced***

***on***

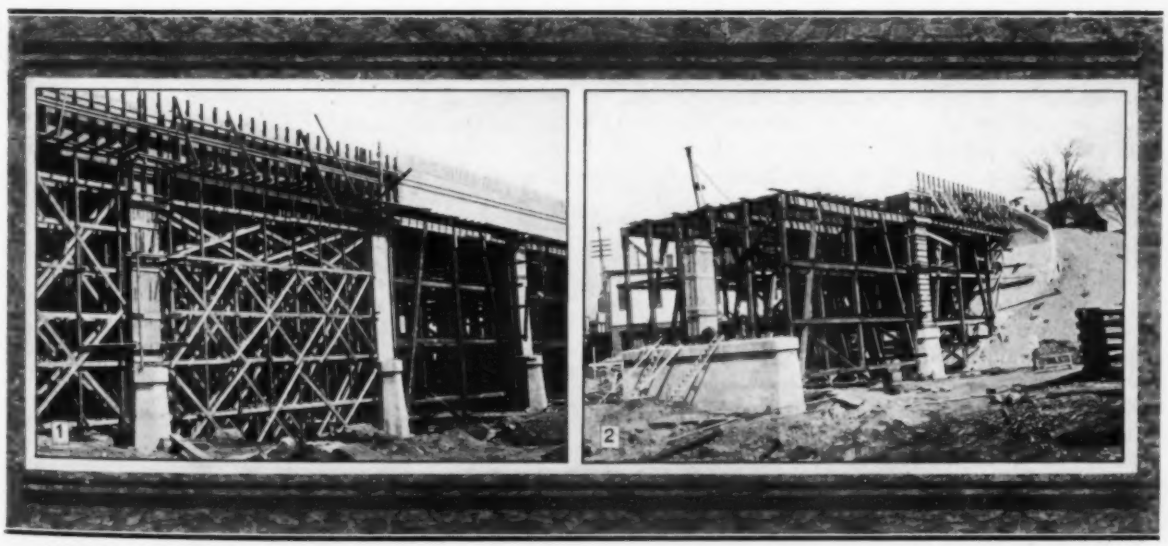
***Gammino Construction Co. Job***

***at Jewett City, Conn.***

AN interesting grade elimination job which included the crossing of one stream twice and a river once was pushed to completion by M. A. Gammino Construction Co., at Jewett City this last season. The work included a 375-foot bridge over the river, a 675-foot viaduct which crossed the railroad, and 2,200 feet of approaches. Notable in the project was the ingenuity of the contractor's superintendent in devising ways and methods for cutting his form work costs and reducing the handling of the concrete.

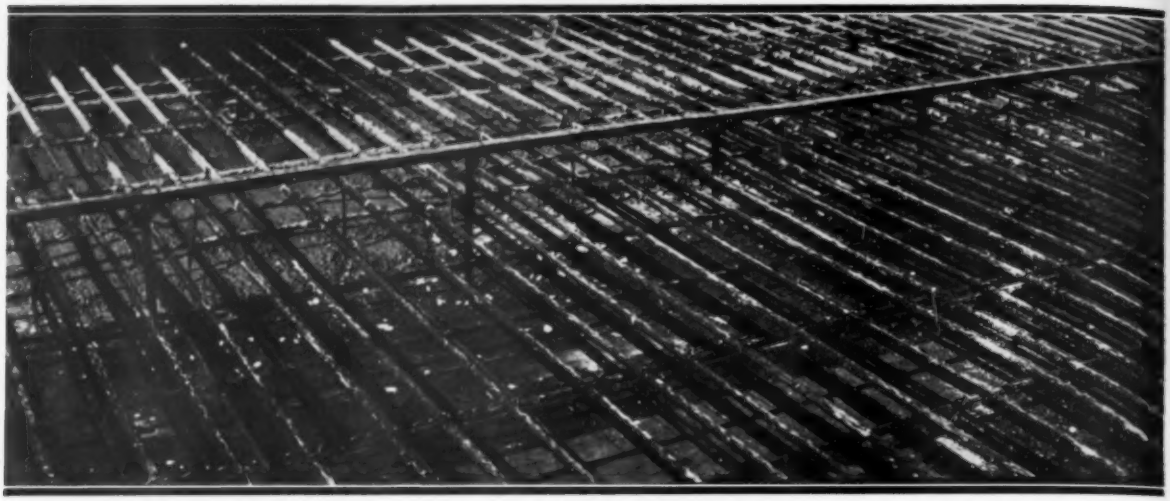
### The Viaduct

The viaduct was of T-beam construction except for the 60-foot railroad span which was deck plate girder encased in concrete to give the same appearance as the



*VIEWS OF THE TWO TYPES OF FALSEWORK USED TO SUPPORT THE DECK CONCRETE ON THE JEWETT CITY VIADUCT, JEWETT CITY, CONN.*

*1. At left, the multiple post falsework showing the veritable forest of timber required to be assembled and taken down in each span. 2. The heavy timber falsework showing the simplicity of this method of supporting the forms for the deck concrete*



*Reinforcing on the Bridge Structure Showing the 1 3/16-Inch T-Bar Supported on Rods Through the Bottom Forms to Show the Grade of the Finished Slab*

other spans. The viaduct as well as the bridge was constructed with a monolithic disk with a 3-inch wearing course placed on the surface of the structure slab immediately after the slab was brought to grade, so as to form an integral monolithic part of the bridge structure. The slab was a 1 : 2 : 4 mix with the wearing surface a 1 : 1½ : 2 mix.

The foundations for the piers of the viaduct were excavated with orange peel and clamshell buckets by two Northwest cranes. The piles for the foundations were of oak, driven to a maximum depth of 35 feet with flying leads and a Vulcan No. O steam hammer, using one of the Northwest machines rigged as a crane. Nine of the piers at the river and railroad crossings were built on piles, because at these locations soil of sufficient bearing value was encountered at too great a depth to make it economical to carry the concrete footings down. The Ransome mast plant poured all of the foundations with a chute, and was used for all of the concrete work for the superstructure as well.

The contractor was most fortunate with low water, for from the time excavation was started October 1, 1929, until all the foundations and piers were poured no trouble was experienced. During the summer, when the drought which caused so much trouble with crops was a matter of concern to others, the contractor was able to carry the lower forms from beneath the bridge and viaduct across the Quinebaug River on a motor truck. All of the Class B concrete for the footings had been completed by April, 1930, with the work continuing all winter. When the temperature was extreme, work was shut down for a day or two, but during most of the winter it was carried on according to schedule with heated aggregates and the forms surrounded with steam coils. The stone was heated in the stock pile with a steam coil beneath, and the sand was dried over culvert pipes with wood fires beneath. There were also steam coils around the batcher and the bins. The paver was equipped with a Hauck torch, which maintained a high temperature in the drum, preventing the chilling of the concrete during mixing. Mixing water was heated by condensing live steam with a 500-gallon tank set between the pump and mixer. No admixtures or anti-freezing compounds were used.

At the start of the work the Erie AggreMeter batching plant was located on the approach fill at about the center of the job, but when spring came the contractor received the award of several contracts for road jobs in the state, and one being quite near, it was thought better to move the plant to a railroad siding, where it could be used for both the viaduct and the road jobs.

The coarse aggregate for the concrete was a graded mixture of 1½ to ¼-inch trap rock from the New Haven Trap Rock Co., New Haven, Conn., which came in by rail, as did all the other material. The sand was produced by the Certified Sand Co., of Avon, Conn. Gravel from ¼-inch to ½-inch was also furnished by the New Haven Trap Rock Co., and was used for the encasing concrete for the girders and beams. When this material was used a 1 : 2 : 4 mix was specified with a 6-bag batch to which an extra bag of cement was added to increase the workability.

### FALSEWORK FOR THE VIADUCT

Two types of falsework were used for the support of the viaduct spans. The more usual mutiple post type and a type using heavy timbers under each T-beam, suported only at each end and three intermediate points. The two types are shown in the photographs. The heavy timber falsework proved most economical and advantageous. It was easier to erect and to remove and gave more room below the forms for the men to work when necessary. The heavy timbers were erected with a small gin pole and gasoline hoist. The four drain pipes which were inserted in each bay of the viaduct, two to a side, were used to put ropes through for lowering the timbers and forms when the work was completed and the forms were dismantled.

### THE RIVER BRIDGE—HANDLING THE FORMS

The river bridge consisted of five spans of 75 feet each with a 28-foot roadway and one 6-foot sidewalk. The whole bridge was of structural steel and concrete. The method of hanging the forms for the encasing of the floor beams was unusual and very effective. The contractor believes that the method may have been used elsewhere but that some of the features are unique.

The floor beams were 33-inch Bethlehem sections

weighing 210 pounds per foot. From the lower flanges the bottom forms for the encasing concrete were suspended by hook bolts. The hook bolts were tested to an ultimate strength of 7,000 pounds, so were amply strong for the work they were called upon to perform. The hooks were placed over the flange and a 3/16 x 1¼-inch strap below the flange extending across from one bolt to the other. The bolt was inserted into a cone nut, which was turned up with a special wrench to hold the hook firmly against the flange and prevent turning. Into the lower end of the cone nut another rod was inserted which passed through the beam bottom, thence between the 4 x 6-inch stringers to the underside of pairs of 2 x 6's, where a plate washer and nut completed the assembly. The cone nuts acted as bolt couplings and also spaced the beam bottom from the steel beam. On top of the pairs of 2 x 6's were placed 4 x 6 stringers above referred to, running longitudinally about 3 feet on centers, which directly supported the beam bottoms and sides, and by means of short posts and ledgers on the beam sides, the slab floor.

In removing the forms the bottom nut was slacked and the 4 x 6 stringers pulled out, and then the beam side forms and the slab forms were taken out, and lastly the beam bottoms and cone nuts assembly, leaving in the concrete only the hook bolt, the exposed end of which was covered when the hole left by the cone nut was patched with concrete. Remarkably good time and excellent work was done with these forms, which were used over and over on the successive panels.

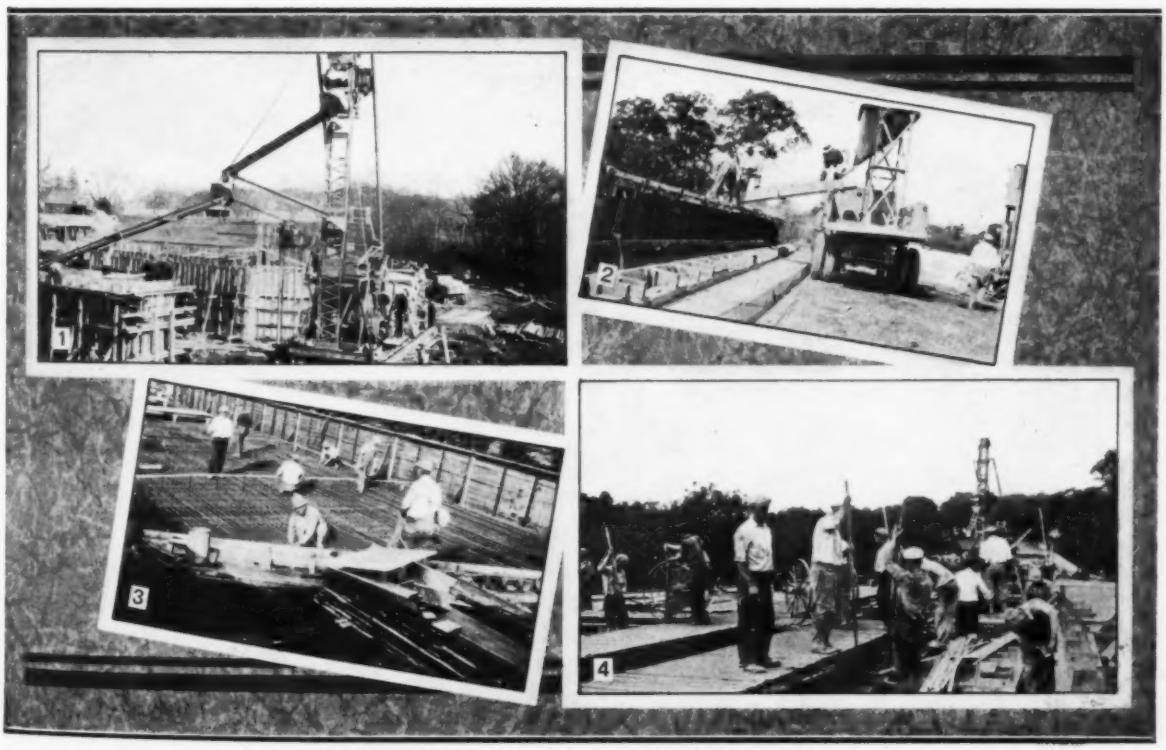
### The Plate Girders

The big plate girders were set from a temporary bridge built at the side of the new structure and the girders were swung into position by a guy derrick. A feature of the design of the structure was the cantilevering of the plate girders 12½ feet beyond the piers at alternate spans. This made the sequence of the pouring of the slab a little different than if they had been continuous as the cantilever sections were omitted until the other sections on either side had been poured. The only inconvenience was that the steel and forms were set for the cantilever section and for the section beyond, and the cantilever section was then skipped and the runways laid over the steel and the concrete buggied to the section beyond.

### Some Details

All form lumber sheathing was 1¼-inch spruce planed to 1⅛ inches, and the beam bottoms were 2-inch spruce. The contractor felt that the day of light form lumber is past, as it makes for better work and less chance of bulging forms to use the heavier material. All of the forms were tied with bolts instead of wires, to insure the solidity of the forms against any warping.

At the end of all panels, which were made 1 inch short purposely, a 1-inch strip was nailed to make a tight fit. Then when the form was pulled only the 1-inch strip was broken and the entire panel was ready to use in another place without further repair other than a new strip, which was quickly nailed to the end. On the job were some of the original panels which were used before the use of a "dutchman" was begun, and in each case they were badly torn at the ends in removing them from the concrete. Some of the panels were salvaged by cutting off an inch at the end and using them the same as the newer panels.




*CONCRETING ON THE JEWETT CITY VIADUCT*

*1. The Ransome mast plant pouring the piers with chutes. 2. The method of pouring the walls from a hopper mounted on a truck. 3. Wiring the reinforcing for the floor slab. Note the grade rod in the middle background. 4. Pouring the floor slab with concrete buggied from the Ransome plant*

### POURING THE SIDE GIRDERS AND HAND RAILING

The contractor evolved a fine scheme for making a substantial saving in pouring the side encasing and the hand railing on the viaduct and bridge. Instead of erecting the high runways which are usually used for this work he mounted an Insley hopper which was generally used for filling the buggies on a 3-ton Mack truck, and ran the hopper under the chute of the Ransome mast plant, filling it, and then drove the truck out over the panel to be poured, and as the gate on the hopper was set at the side it was possible to chute the concrete directly into the side forms with a minimum of effort. This eliminated high runways, which were expensive to construct and saved in labor, as no men were needed to push the buggies.

The inside girder forms ordinarily are set directly on the curb, but the one per cent grade of the bridge made the cutting and setting of them with the panels vertical a very difficult matter. To overcome this and to save time the contractor cut the forms a ¼-inch shy at the bottom, and set up the forms to line and grade with small wedges at the bottom. When the concrete was poured there was a slight leakage beneath the form, but this was removed and touched up by the hand finisher. By this simple method, and the scheme described below, the contractor actually cut his cost of handling the girder forms to one-quarter of the original cost.

On these same forms at first one panel was set at a time, but a little thought given to them showed that time and money could be saved by taking the 9-foot panels and making them up for an entire span. The individual panels were laid face up on the grade and lined up and then spiked together carefully. No bolts were used to hold them together, as it took too much time for the boring of the holes. After the forms were spiked they were lifted into place by a large gang of men in a few minutes. In this way the men could see what they were doing.

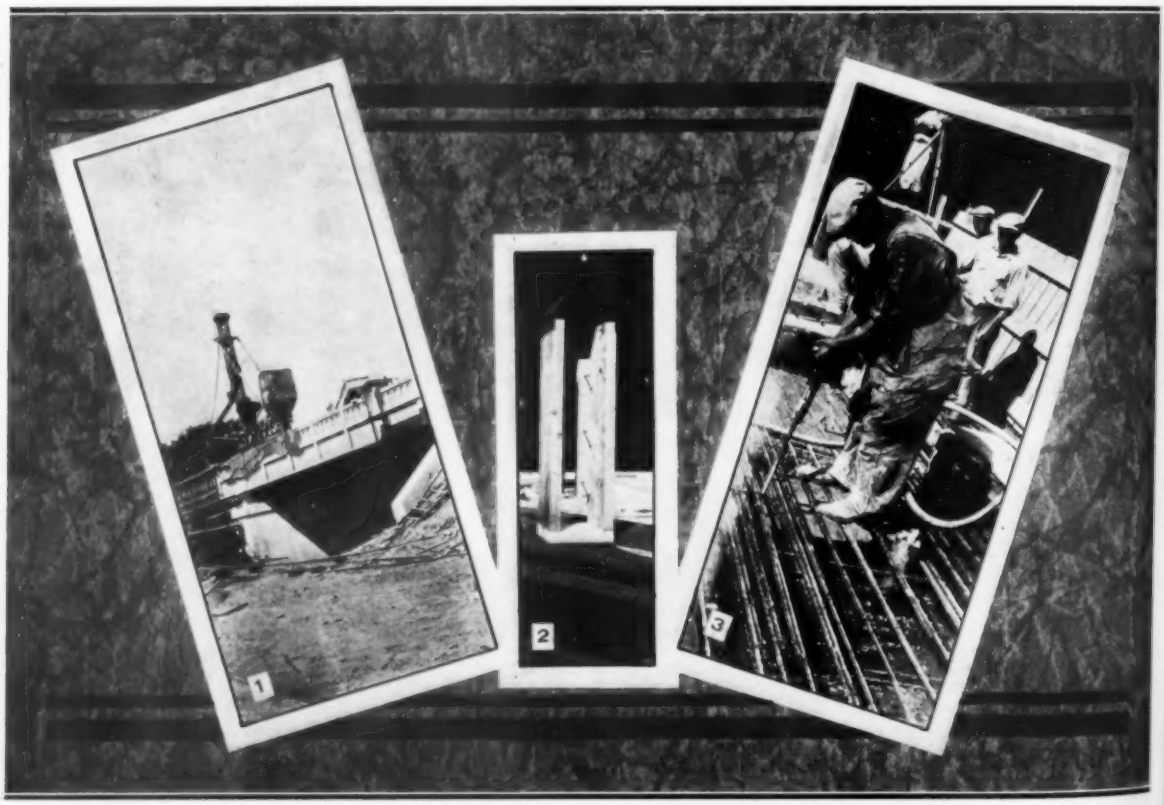
### LABOR ORGANIZATION

The contractor operated on an open shop basis except for the carpenters. There were 20 carpenters on the form work about evenly divided between the viaduct and the bridge. There were six men at a maximum buggying concrete for the pouring of the encasement concrete and for the slab and wearing surface. When the first decks were poured the paver was kept on the land at the approach between the viaduct and the bridge. As soon as the spans had cured sufficiently the paver was moved onto the structure, which materially cut the costs of placing the concrete. It was not until five spans had been poured that it was possible to bring the paver forward onto the viaduct.

On the form work one circular and one band saw were used, the former doing most of the work. For light cuts and particularly careful work an electric Skilsaw was used. Water for the paver was supplied by a C H & E triplex pump located on the bank of the Quinebaug River.

With the labor organization described and methods

(*Continued on page 81*)




*SOME DETAILS OF THE JEWETT CITY BRIDGE AND VIADUCT JOB*

1. *The Ransome mast paver pouring slab on the bridge.* 2. *An individual viaduct post form.* 3. *Vibrating the forms with a chipping hammer during the pouring of the slab by buggying from the paver*

# *The* Road Builder *and the* Layman

## *Engineers Design and Contractors Build Fine Roads Does the User Appreciate Their Work?*

*A Roadway Hewn Out of Solid Rock Cliff Near Lower Falls, Cullisaje River, N. C.*

By

**Byron Scott Marsh**

***Civil Engineer***

***North Carolina State Highway Department***

IT is a strange corollary on the development of our really remarkable highways that as soon as one is completed and turned over to the public for use, all the skill and genius and the toil and sweating that comprised its making are forgotten, brushed aside as a trivial consequence. Perhaps it is no more than natural that this is so. A well-located, well-planned and well-constructed road fits its environment like a glove. The layman's reaction to it is a feeling that it is just where it belongs and that it just naturally grew there without human endeavor.

Engineers and contractors are partially responsible for the lack of recognition their work receives. With due apologies to Mr. Volstead, they have always been too dry. There is a Sahara-like aridity to the average engineering report. In submitting a treatise covering a survey, no matter how difficult a construction project, no matter how stupendous, they will, inherently, vest it with an unembellished array of pure facts and figures, the result of which is a dry quality of literature neither interesting nor understandable to one not thoroughly versed in the subject at hand. So many miles, the report may say, cost so many inanimate dollars and cents or took so many drab days. Nothing of palpable interest there, no pulsing sense of human endeavor, no skillfully arranged background of stinking sweat and raw, red toil or of facts and incidents encountered stranger and more romantic than fiction itself.

### Taking Mr. Average Man on a Personally Conducted Tour

If Mr. Average Man could be taken on a personally conducted tour encompassing the entire development of a modern highway from its inception to its final completion, he would find himself for a while at Highway Headquarters, surrounded by a maze of figures and financial statements that would do credit to a clearing house, and from which he would have to decide whether or whence the funds were coming with which to build a new road from X to Y. Having settled this little matter, he finds himself now studying a mass of maps and miscellaneous data, and soon he must decide which of several is the logical route to be developed and what type of road can be economically justified.

*Engineers' Camp High Up in the Nantahala Mountains of North Carolina*

Then, too, he will come into intimate contact with the peculiarities of human nature and the insatiable demand of local bosses and petty politicians.

He will spend the next several months with a hard-bitten locating party. "Fine," he says to himself, "those surveyors have it pretty soft and we'll have a big time out in camp." But he becomes a sadly disillusioned human about the time that he discovers that it is several miles from his usual haunts to this alleged place of rest and recreation, and that the only means of transportation thereto is via "Shoeleather Express," or the still worse sadly dilapidated, even murderous, highway commission flivver. Arriving in camp, he makes the intimate acquaintance of hardwood handles and of blisters and sore feet, of hungry gnats and poisonous vines, of that degree of tiredness when one becomes too tired even to quit.

Becoming somewhat inured to the life he begins to realize that there is something to it all in spite of his preconceived notions. He finds that logical routes are the result of arduous, observant, many times risky work and investigation; that ruling grades, curvature, volumes of material, etc., are not just the glib argot of the profession, but that they are living terms which take on new values in this business of outwitting nature that man may go and come at will.

A few months and we turn our tyro over to the Planning Department, where he finds that plans and profiles and cross sections and figures can be and are sorted and classified and studied and revised in such an enlightening manner that dollars and cents and miles and materials take on direct ratios to one another that he never before suspected.

### Building the Road

Completing his tour of the locating and planning departments, he starts merrily out to build him a road. "I know it all now," he surmises, "it was deeper than I thought, but there'll be nothing to do now but carry out the plans, ridiculously simple." About this time his predilections are rudely interrupted and it is demanded to know: "How long will it take, what equipment, how much dynamite, how many men, etc. etc.," and, "when you get time I want to talk with you about Jones' Farm. He says somebody is going to be carried out feet first if they start tearing up his meadow," and "The County Commissioners over at Anytown have demanded that we change our plans over at Somewhere," and "Senator Sorghum is down

*Road Building Alongside the Tuckaseegee River, Smoky Mountain Region, North Carolina*

*Heavy Grading Through the Cowee Mountains, North Carolina*

there behind the shovel with his car stuck and threatening to have your job if you don't stop whatever you are doing and get it moved for him. Says he saw the detour sign all right, but what in tarnation's the use of his working for road bonds if he can't be taken care of," and "there's a special wire from the testing department ordering that we discontinue the use of, etc., etc." Our tyro has had enough. "It's too much for me," he says, and goes his way a sadder, wiser man.

### Railroad Building and Road Building

The unheralded road builders, apt as not to be working under the direction of higher officials whose conception of roadbuilding is, to say the least, very remote, have had to meet and overcome even greater obstacles than did their railroad predecessors. A highway being more elastic and of far greater lateral dimension than a railroad, they have encountered new hazards and new problems. There is a vast difference between laying steel rails on ties on a narrow roadbed and placing and finishing a modern pavement from 16 to 60 or more feet wide, so as to furnish a smooth riding surface throughout its dimensions. There is a difference between a spidery trestle or narrow bridge and throwing a full width, solidly surfaced highway across a stream. It may even be conceded that the problem of hewing out of the side of a rocky mountain a 40-foot wide, smoothly finished roadbed assumes more Herculean proportions than that of hewing out of the same mountain side a 16-foot shelf that ties and steel may be laid thereon.

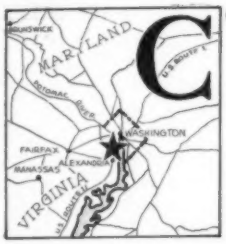
### The Cub Reporter Said——

A short while ago there appeared in a widely-read newspaper a feature article, extolling the beauties of and calling attention to one of North Carolina's famous scenic highways. One paragraph of that article is worthy of attention as indicative of the care-free, casual acceptance by the public of the accomplishments of its road builders. The supposedly erudite writer in describing a certain portion of the highway, worded his remark thus: "At the third waterfall the engineers, either through accident or intent, have done something that will draw exclamation from the most blasé, etc., etc." Either through accident or intent; what casual recognition of a hard fought line through what was previously considered an inaccessible region. Is the reader to believe that road location is a matter of acci-

(*Continued on page 63*)

# Widening Famous U. S. Route 1 *in* Northern Virginia

## *Contractor Handled Concrete Base-Asphalt Top Job With Materials from Commercial Plants*




COMPLETE plants for batching aggregates, mixing concrete and making the various hot mix tops are no longer needed by contractors in certain sections of the country where the highly developed ready-mixed concrete business has taken hold and where commercial hot-mix plants have been set up. Such was the case with the contract awarded to John H. Olcott, Contractor, of Clarendon, Va., for the widening of 1.9 miles of U. S. Route 1 from the District of Columbia line south toward Alexandria, Va. Without a mixer or paver on the job the contractor was able to lay a large yardage of 1:2½:5 and 1:2:4 concrete for widening the old concrete and Besonite surface and for patching the surface where it had disintegrated under the heavy traffic of this important artery. Then without owning or renting a hot-mix plant he laid the sheet asphalt top with as much speed as though he had complete control of the plant.

### Grading

Work on grading this job started October 15, 1929, and was stopped about December 1 because of the weather. Grading was resumed on April 1, 1930 and the job was completed within the time limit of the contract, June 10, 1930. The contract had a bonus and penalty clause of $10 a day for completion ahead of time or for failure to complete within the specified time.

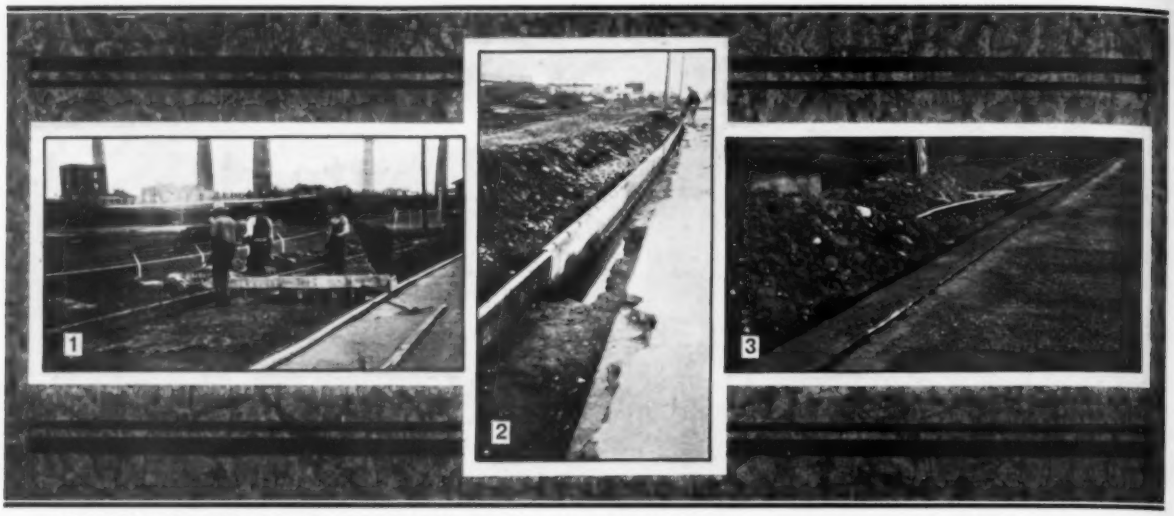
As the old road was only 18 feet wide and the new section 30 feet considerable fill was necessary and some grading on the old right of way. For fill a total of about 10,000 yards of earth was hauled an average of ½ mile in hired trucks on a yardage basis. Fill was loaded by a General shovel from a borrow pit about ¼ mile from the roadway. All fill was placed in 12-inch layers and rolled with a 12-ton Buffalo-Springfield steam roller after being spread by a 5-ton Caterpillar tractor and blade grader.

The drainage structures consisted of lines of corrugated iron pipe varying from 12 to 24 inches in diameter. The shoulders consisted of earth thrown against the curb and rolled to compaction with the 12-ton roller.

### Concrete Patches and Widening Strip

A labor gang of 35 men was used to prepare the subgrade and to set the 8-inch Blaw-Knox steel forms for the concrete widening strip and the curb which measured 8 inches wide and 2 inches above the slab. Over a section about 800 feet long alongside a swamp it was necessary to put in a large amount of extra fill before the subgrade was sta-

*A Detail of Widening and Patching with Concrete*



*DETAILS OF WIDENING WITH CONCRETE IN PREPARATION OF ROAD FOR ASPHALTIC TOP*

*1. Preparation of subgrade by hand and checking with scratch board for concrete widening strip. 2. Detail of setting two forms, one above the other for narrow widening strip on unstable ground. 3. Detail of concrete curb and bond with asphalt top*

bilized and then to be sure of the widening slab it was thickened to 8 inches and reinforced. The concrete for patching areas where the entire section of old pavement had to be removed was a 1:2:4 mix which was carried to within 2 inches of the final grade of the new pavement to save the asphalt.

On the section where reinforcing was used the concrete was cured with an application of Grasselli silicate of soda on the surface instead of the admixture of calcium chloride used in the base.

### SHEET ASPHALT TOP

Ten days were required by the specifications between the pouring of the concrete base and the laying of the sheet asphalt top. The sheet asphalt mixture was purchased from the Highway Engineering & Construction Co., 7th and T Streets, Washington, D. C.

For the forking and raking of the hot sheet asphalt mixture the contractor used a crew of 5 men forking and 4 men raking. The top was immediately rolled with two Buffalo-Springfield tandem rollers. One of these rollers was used on the subgrade to speed up the work of the three-wheel roller.

### PERSONNEL

A. F. Campbell was in charge of this job for the contractor, John H. Olcott, Clarendon, Va., with Tom Havener as Superintendent. The work for the State Highway Department of Virginia was in charge of J. C. Albright, District Engineer, and R. I. Mount, Resident Engineer.

## "Raised Bread" Concrete—A New Building Material

A BUILDING material which rises like bread to two and three times its original volume, is from 66 to 75 per cent lighter than concrete, and so hard that a weight of 370 pounds to the square inch leaves no impression on its surface, has disclosed unusual fire resistive properties in tests made by Professor Albin H. Beyer, of the Department of Civil Engineering, Columbia University.

The material is composed primarily of portland cement and concrete, with the addition of lime and a small quantity of aluminum powder and soda. When poured out in a semi-liquid form the aluminum powder generates hydrogen in the liquid mass. A layer of liquid floor filling 2 inches deep will rise within an hour to a height of 5 inches or more, drying rapidly as it expands.

The fire, load and water tests, which were conducted for the Bureau of Buildings of the City of New York and the State Department of Labor at the fire testing station maintained by Columbia University at Greenpoint, L. I., were applied to a floor made of this material. Half of the floor was laid to a depth of 4½ inches and the other half was 10½ inches thick with a ½-inch portland cement mortar finish.

To stimulate actual building conditions, the floor was subjected to a load of 150 pounds to the square foot. Since the maximum temperature in a burning building of modern fireproof construction has been found to reach an average of around 1,700 degrees Fahrenheit, the temperature of the furnace directly under the flooring was kept above that figure for more than four hours. During the last three and a half hours of the test the temperature averaged 1,804 degrees, and at one time reached 1,910 degrees. These temperatures were taken near the under surface of the floor.

Temperatures on the upper surface of the thinner floor, which had expanded, due to the hydrogen, from an original thickness of 2 inches, rose only 2 degrees at the end of the first hour, although the temperature of the furnace below it averaged 1,566 degrees. During the last hour of the test, in which an average temperature of 1,825 degrees was maintained under the flooring, the top surface temperature ranged from 139 to 207 degrees.

At the end of the fourth hour the hottest surface temperature recorded at any point marked an increase of 11 degrees. The other sections showed increases of 12, 10 and 8 degrees, although a fire hot enough to melt silver and copper was raging directly below the floor.

As soon as the test was completed, streams of water were turned on the flames and the concrete construction. Extra weight was then put upon the thinner section of the floor until the load averaged 450 pounds to the square foot. Measurements showed that under such a weight the maximum floor deflection was 2 inches. As soon as the load was entirely removed, the deflections reduced to 1½ inches.

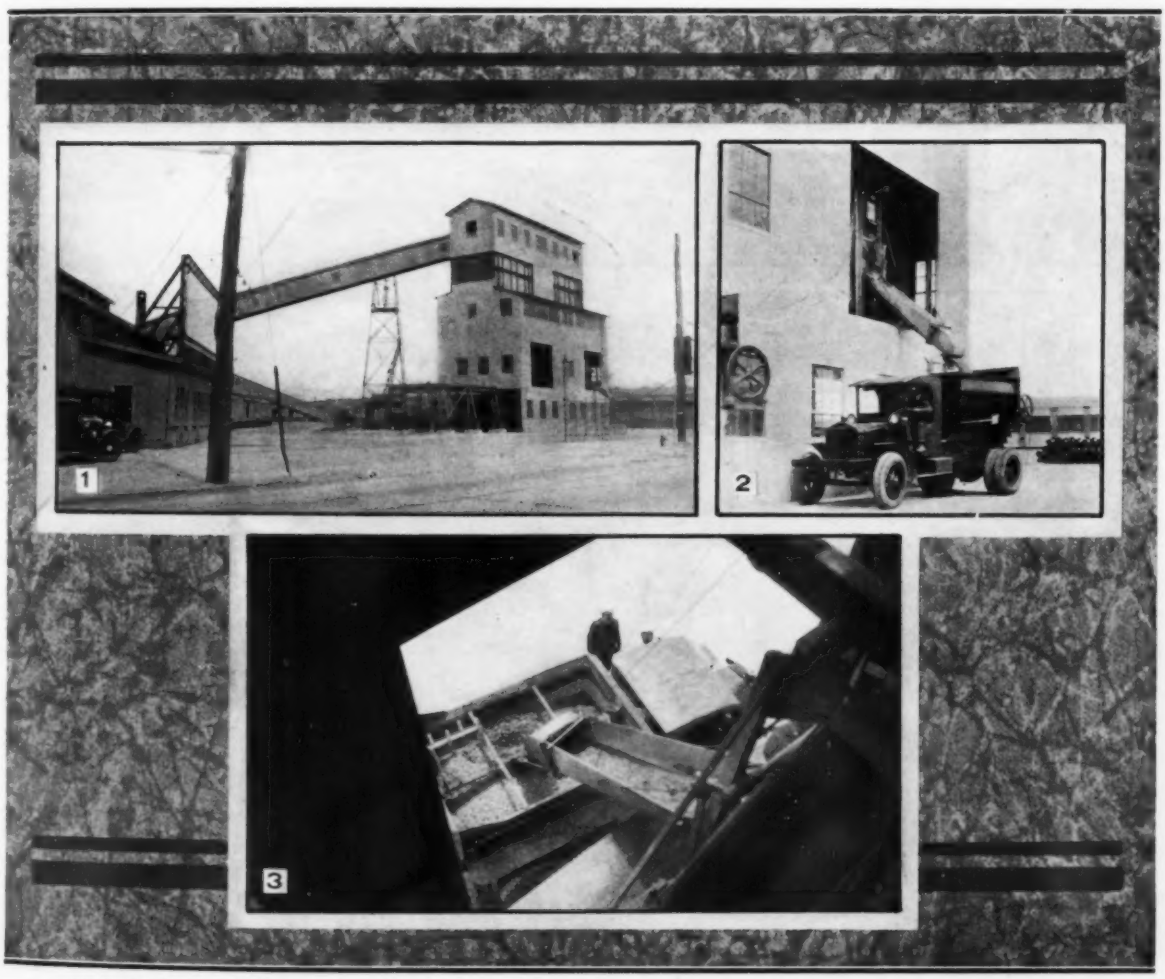
*Another*

# Ready-Mixed Concrete Plant Serves Contractor-Owner *and* Large Clientele

WHEN you think of a ready-mixed concrete plant what do you picture—dirt and cement all over everything, a pair of ruts into which a truck has to back to get to the batcher, or do you think of a clean, well-cared-for plant, housed in galvanized iron with a total absence of dirt and dust?

Unfortunately, there are many plants of the first type, but that which has been constructed by George M. Brewster & Son in Bogota, N. J., may well be taken as an example of "What the well-dressed ready-mixed plant will wear."

George M. Brewster & Son operates a large material




*THE READY-MIXED CONCRETE PLANT OF GEORGE M. BREWSTER & SON, BOGOTA, N. J.*

*1. The complete plant showing the aggregate conveyor at the left. 2. Loading one of the Blaw-Knox agitator trucks from the 3-yard Ransome mixer. 3. Loading the truck as seen from the mixer operator's platform*

yard in Bogota and also handles a big contracting business involving road construction. When ready-mixed concrete began to be talked of, this organization quickly realized that, operated by its material yard forces, a ready-mixed concrete plant would be a most desirable adjunct to its business and also assist in its contracting work. Plans for a complete plant were quickly drawn up, studied, altered, revised and finally accepted and the structure built.

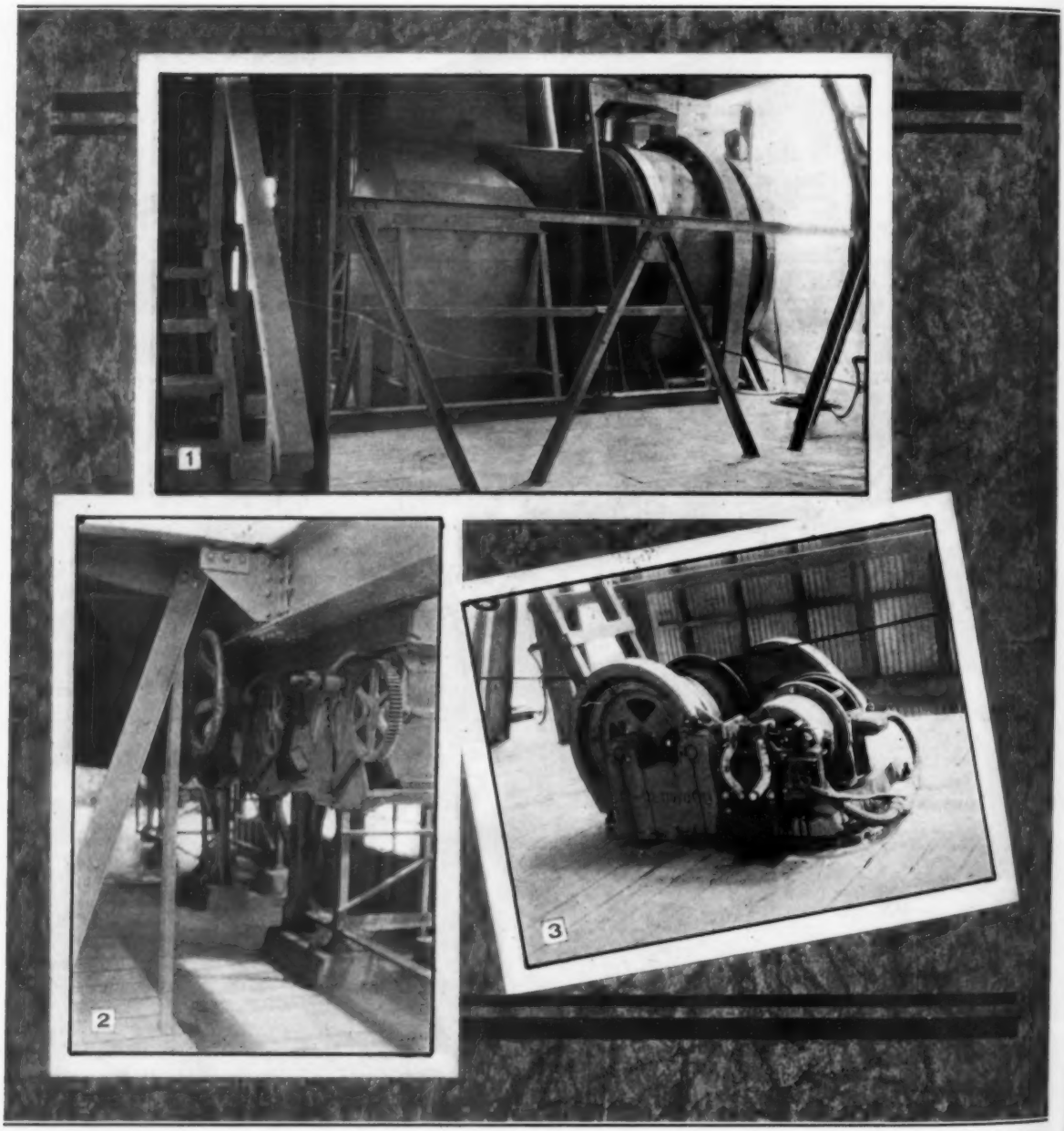
### THE BUILDING

The galvanized iron building to house the plant was erected around a framework of structural steel measures larger in area for the first three stories than for the upper two stories which are set back and which contain the storage bins.

At ground level trucks can drive along the outside of the front of the plant to secure their loads of ready-mixed concrete or can drive through the plant along its longer dimension and receive proportional batches from a novel series of hoppers which will be described later.

### MATERIAL HANDLING

Sand and stone are received by barge on the Hackensack River adjacent to the plant and are unloaded by one of the two 30-ton Browning locomotive cranes,




*INTERIOR VIEW OF THE GEORGE M. BREWSTER & SON READY-MIXED CONCRETE PLANT AT BOGOTA, N. J.*

1. *The 3-cubic yard Ransome mixer.* 2. *The 12-box dry-batch gantry for fast loading of trucks.* 3. *The electric hoist that spots the gantry under either of the batching units*

which operate all over the yard, into a cylindrical receiving hopper which delivers the aggregate to a Barber-Greene conveyor. This covered conveyor delivers the sand or stone to a shuttle conveyor which discharges the material into the duplicate 3-compartment Blaw-Knox bins of 300-ton capacity each. Most of the work is according to the State specifications requiring 1½ and ¾-inch stone, and sand.

Cement is received by rail, the cars being spotted in the yard and the bags being delivered by belt conveyor to the batcher platform. Studies are now under way leading to the possible installation of equipment for handling bulk cement for this plant.

Batching is done entirely by weight with Blaw-Knox batchers, but a novel device on each of the bins permits, by the mere throw of a crank, the delivery of dry batches to hoppers below for delivery to trucks or to the mixer.

Water for the batches is accurately measured in a cylindrical tank with a movable center scupper by which water beyond the amount necessary for the batch is wasted.

The plant is equipped with a Ransome 3-yard mixer. The mixed batches are delivered by chute, as shown in one of the illustrations, direct to the agitator trucks which deliver the product anywhere within hauling distance. Hauling is done by Blaw-Knox agitator bodies mounted on Mack chassis.

All concrete produced by this plant is certified by the Haller Testing Laboratory, of Plainfield, N. J.

The plant is washed down every night, the operation taking about one-half hour. It is interesting to note that only two men are employed in the normal operation of the plant and that the mixer operator has been in charge since the plant was opened nearly eighteen months ago.

### Speedy Loading of Dry Batches

The duplicate hopper and batcher which has not yet been equipped with a mixer, is used to supply dry batches where it is more economical to mix on the job and for customers who have their own building mixers and pavers. Under ordinary conditions considerable time is wasted in duplicating the operations of weighing out the two sizes of stone and the sand for the dry batch after the truck has arrived at the plant. A truck would be delayed while four separate and complete batches were weighed out. This delay has been overcome by the installation of a gantry on which runs twelve hopper boxes which are loaded by the batcher operator successively and then dumped quickly as the truck arrives at the plant.

The gantry can be run from one end of the plant to the other so that the boxes may be filled by either of the batching units. The boxes are moved as a unit by a small Lidgerwood hoist, operated by a General Electric motor. This time-saving scheme was worked out personally by William J. Brewster, Secretary-Treasurer of the company.

## The Road Builder and the Layman

(*Continued from page 58*)

dent or that locating engineers are stolidly unattentive of or carelessly immune to scenic values?

### The Contractor's Part

One could go on indefinitely picturing the trials and tribulations of the highway engineer alone, and they are all too true, but let us not forget that the "shock troops" of the road building army are the actual construction forces: contractors, superintendents, operators and laborers. What price all the staff work of the engineer if they don't come through?

The technically inclined highway engineer is concerned with quantities, as such, more or less abstractly. The construction man must consider them concretely, as something to be picked up from one place and put down in another, or as materials to which some process or service must be applied to render them useful. On the construction man rests the final burden of economic and satisfactory construction. The engineer decides where and how the road shall go; the construction man puts it there.

Adverse weather conditions, stubborn obstacles and catastrophies of Nature's making, mechanical and human imperfections and the ever-threatening fluctuation of costs. These are the construction man's ever-present adversaries. A matter of record for the technically inclined engineer. The snorting power of the big shovels, the ring of the drills, the song of the mixer, the proper task for each and every individual and machine, all these are the song of life for the construction man; merely a matter of record for some engineers. However, be the problems and adversities what or when they will, good construction is dependent on good engineering, and conversely good engineering must depend on good construction. A good road is dependent upon both, a product of the road builders.

### The Motorist

To the average motorist a road is just a road. To be cussed fluently if a bit rough or crooked, to be "burnt up" and forgotten if good. A thing that one is entitled to kick about if it doesn't suit one's fancy, but, conversely, an inanimate thing raising no hue and cry for recognition nor sounding any brazen demands for praise. The aesthetic senses revel in the panorama of beauty, the mechanical senses thrill to the inspiration of power and speed, the mechanical senses bow to the superb performance of the modern motor car, but how many travellers, riding comfortably and safely through the rocky gorges or over the sulky impregnability of high-flung mountain ridges, give even a transient thought to the ingenuity, the perseverance, the plain hard work that must have preceded the making of their journey possible?

## Hot Cement

BUILDING Research Bulletin No. 7 entitled "Hot Cement," and written by N. Davey has recently been published by the Department of Scientific and Industrial Research of England. To meet the increasing demand for large supplies of portland cement, manufacturers have shipped cement direct from the mill to the job, with the result that the cement is still hot, and there has been considerable question as to the advisability of using the cement in such a condition. To answer such inquiries the British Building Research Station carried out a number of tests, in which the leading manufacturers of portland cement collaborated.

These tests and their results are described in this pamphlet, copies of which may be secured from the British Library, 551 Fifth Avenue, New York. Price: 14 cents postpaid.

# Two Complete Dirt-Moving Outfits *on* One Grading Job

## *Steam Shovel and 3-Up Wagons and Power Shovel with Trucks and Wagons*

*A View Along J. D. Liles' Section Showing His Bucyrus-Erie ¾-Yard Steam Shovel and His String of Wagons*

AN entirely new location for Tennessee State Highway 34 between Johnson City and the Bluff City concrete road from Johnson City to Bristol was started this year as Project 224-A, the contract for the grading being awarded to Young & Lyons of Rogersville, Tenn. A section about 4½ miles in length was subbed to S. A. Breeland. The two outfits that were working on the grading were somewhat similar but offered interesting contrasts because of the different materials in which they were operating at the time these observations were made about the third week of May.

### The S. A. Breeland Subcontract

J. D. Liles, who was in charge of operations for S. A. Breeland, is a dirt-mover of considerable experience and kept the entire organization on its toes by operating the Bucyrus-Erie ¾-yard crawler steam shovel himself most of the time. Thus he was in a commanding position to see whether there were enough wagons on the job, whether there were any slackers in the outfit and he swung his shovel into action so rapidly that he was clocked over a considerable length of time on a side hill cut where he was loading 1½-yard Watson wagons on a ¼ swing, two buckets to the load, with a wagon pulling out with a load every 35 seconds. On this particular day the haul was about 600 feet, but the average haul on the section was about 300 to 500 feet. Mr. Liles operated from 11 to 15 wagons with 3-up mule teams.

"One thousand yards in a ten-hour day, with a ¾-yard shovel," is Mr. Liles' aim and he accomplishes it day after day. He says that he has been doubted many times but that this is no idle boast and he is willing to have anyone check him in fair running. There was no lost motion in the outfit the day we clocked it and the wagons only hesitated just before moving under the bucket and then again under the shovel and off they were to the dump.

### Harder Going in Rock Outcrops

Young & Lyons had by far the harder section to tackle as most of the 32,049 yards of rock estimated on the project was in their section. The total earth excavation for the job was 96,852 yards.

In spite of a rather mean location at the time they were having the "once-over" the Young & Lyons Bucyrus-Erie GA2 1-yard gas shovel was making a good showing. The shovel was digging into a hill with a rock outcrop at the right and another at the left with just enough room for the crawlers to get through. It was necessary for the shovel to make a half turn either way to load the wagons and trucks. The hauling fleet consisted of two International trucks with Superior self-dumping bodies and two Watson wagons with 3-up teams. For longer hauls and when the going was more favorable to reaching the shovel, two additional wagons were used and an Athey dump trailer hauled by a Caterpillar Thirty.

With the two trucks and two wagons under the con-

ditions outlined above, the shovel was placing two heaping buckets of earth on nine hauling units every ten minutes. The wagons ran over the fill and dumped as they went over the edge while the trucks turned on the fill and backed to the edge. Two men were used to trim the fill and spot the loads. The trucks were equipped with dual balloon rear tires with chains on the outer tires. When the trucks backed a little too far and went over the edge of the 8-foot fill they kept right on backing as the grade was firm and ran around the fill and back to the shovel. When the hauls were longer and the going not so good the Athey rear dump wagon proved a boon to the contractor as it could pull through far worse going than even the trucks and with nearly three times the load. On short hauls the Athey crawler and trucks were used and the teams taken off and placed on fresno work. This method was very pliable as no part of the outfit was ever idle. Two Baker Maneys with one Caterpillar Thirty tractor completed the outfit.

The Caterpillar tractor and 2 Baker Maneys excavated around 200 cubic yards per day. They worked on light work and when the Erie gas shovel did not need the teams they were placed with the Maney outfit.

### PERSONNEL

Work on this project was under the charge of C. F. Hommermiller, Resident Engineer for the State Department of Highways and Public Works. B. G. Young, was in charge of the contract for Young & Lyons, Rogersville, Tenn., and S. A. Breeland, with J. D. Liles, Bluff City, Tenn., running the latter's outfit.

## Control of the Silicosis Hazard in the Hard Rock Industries

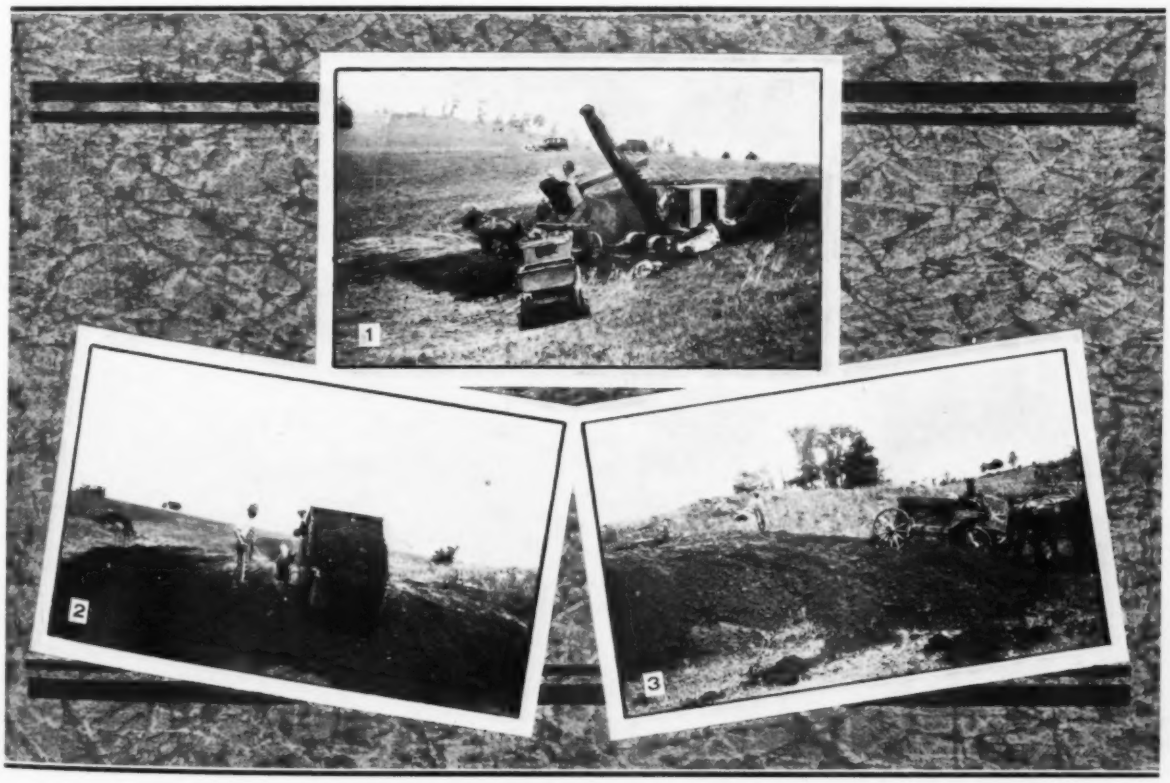
A RECENT addition to the publications from the Harvard Engineering School is a pamphlet "Control of the Silicosis Hazard in the Hard Rock Industries," a laboratory study of the design of dust control systems for use with pneumatic granite cutting tools, prepared by Theodore Hatch, Philip Drinker and Sarah P. Choate, from the Department of Ventilation and Illumination, Harvard School of Public Health, and the Department of Sanitary Engineering, Harvard Engineering School.

This paper is a presentation of the results of a laboratory investigation of the fundamental engineering problems involved in the design of efficient dust control systems for use with high speed pneumatic stone cutting tools, the use of which in hard rock has created a serious health problem. The paper includes diagrams and tables of suggested methods for dust control.

## Specifications for Brickwork

SPECIFICATIONS as generally written for brick masonry are very likely to contain provisions not in accordance with current practice, or more possibly, neglect to specify certain requirements which are necessary for masonry to perform successfully the work intended. With this thought in view the Common Brick Manufacturers Association of America has prepared suggestions in pamphlet form entitled "Specifications for Brickwork and Other Essential Information."

These specifications, with suggestions and notes, are presented in a practical form, and one which can be utilized with a minimum of work on the part of the specification writer. The pamphlet contains in addition to the specifications proper some illustrations and other helpful material. Copies may be secured from the Common Brick Manufacturers Association, Cleveland, Ohio at 15c each.




*DIRT MOVING WITH TRUCK AND WAGON*

1. *Bucyrus-Erie 1-yard gas shovel loading a Watson wagon. 2. One of the International trucks backing to dump over edge of fill. 3. A wagon and team dumping at side to widen the fill*

# Brush *and* Stumps

# Bulldozed *to* Dumps

## *Contractor Worked Tractors to Limit to Save Labor on 3.87-Mile Concrete Road Job with Heavy Cuts and Fills*

CAMOUFLAGE was developed to a high grade of effectiveness during the World War. When one visited the Consolidated Production Co. job between Bedminster and Gladstone, N. J., during rough grading, he was led to believe that the art had not been forgotten, for, when driving over the rough grade, a huge pile of brush apparently blocked the way and then began moving ahead. Behind the pile of brush was a Caterpillar Sixty with bulldozer merrily pushing the load along to a convenient dump, where other piles of brush and stumps awaited just the right day to throw on a gallon or two of gasoline and a lighted match to dispose of them.

### Rough Grading

Grading started November 15, 1929, on this job which had some fills running up to 39 feet high and cuts 20 feet deep, with 100 per cent relocation. The heavy grading started at the Gladstone end with the biggest fill and the deepest cut located at about the mid-point of the job. Two Thew-Lorain 75's and a Koehring 501 shovel handled practically all of the heavy work, with three Caterpillar Sixties with bulldozers used to clean up around the shovel, thus doing away with pitmen. The earth excavation amounted to 164,000 cubic yards at 50 cents, and rock excavation, 34,000 cubic yards at $1.25. Rough grading was stopped for about two weeks the middle of February, 1930, when the weather was too severe to attempt economical work. As a matter of fact, during most of the winter when the temperature was running 10 to 12 degrees below zero the equipment was started in the morning with ether.

### Handling Stumps and Brush

Some rather large trees were encountered along the right of way, the stumps of which were loosened with small charges of dynamite and then pulled out with a Mead-Morrison crane and ¾-yard bucket. Where the stumps were too heavy for the crane, a Caterpillar Sixty climbed up into the woods and pushed the stumps over into the cut and then pushed them along to the fill. The brush was similarly handled, some of the stacks which were pushed along being the equivalent of 8 to 10 large truckloads.

### No Time Lost

The Consolidated Production Co. believes in keeping every man and every piece of equipment working all the time. If there is the least chance of a delay at any point the equipment is immediately moved to a point where it can be more effective. When delayed on one of the cuts, the shovel dug itself out, casting the dirt to the top and the hand labor went in and put in a line of French drain. When it was possible for the shovel to come back and operate in that cut, the bulldozer pushed the dirt off the tops of the banks practically into the shovel bucket, and it was loaded promptly into the fleet of 15 to 16 hired trucks which operated throughout the winter, hauling to fill.

### Rock Work

A Schramm portable compressor operating three Chicago-Pneumatic No. 10 jackhammers was used for the drilling. At the Gladstone end where the rock was hardest, Atlas 60 per cent gelatine dynamite was used, while in the central portion 40 and 20 per cent were used, the latter being on the top where the shale was fairly well disintegrated.

### Concrete Bridge Completed in Zero Weather

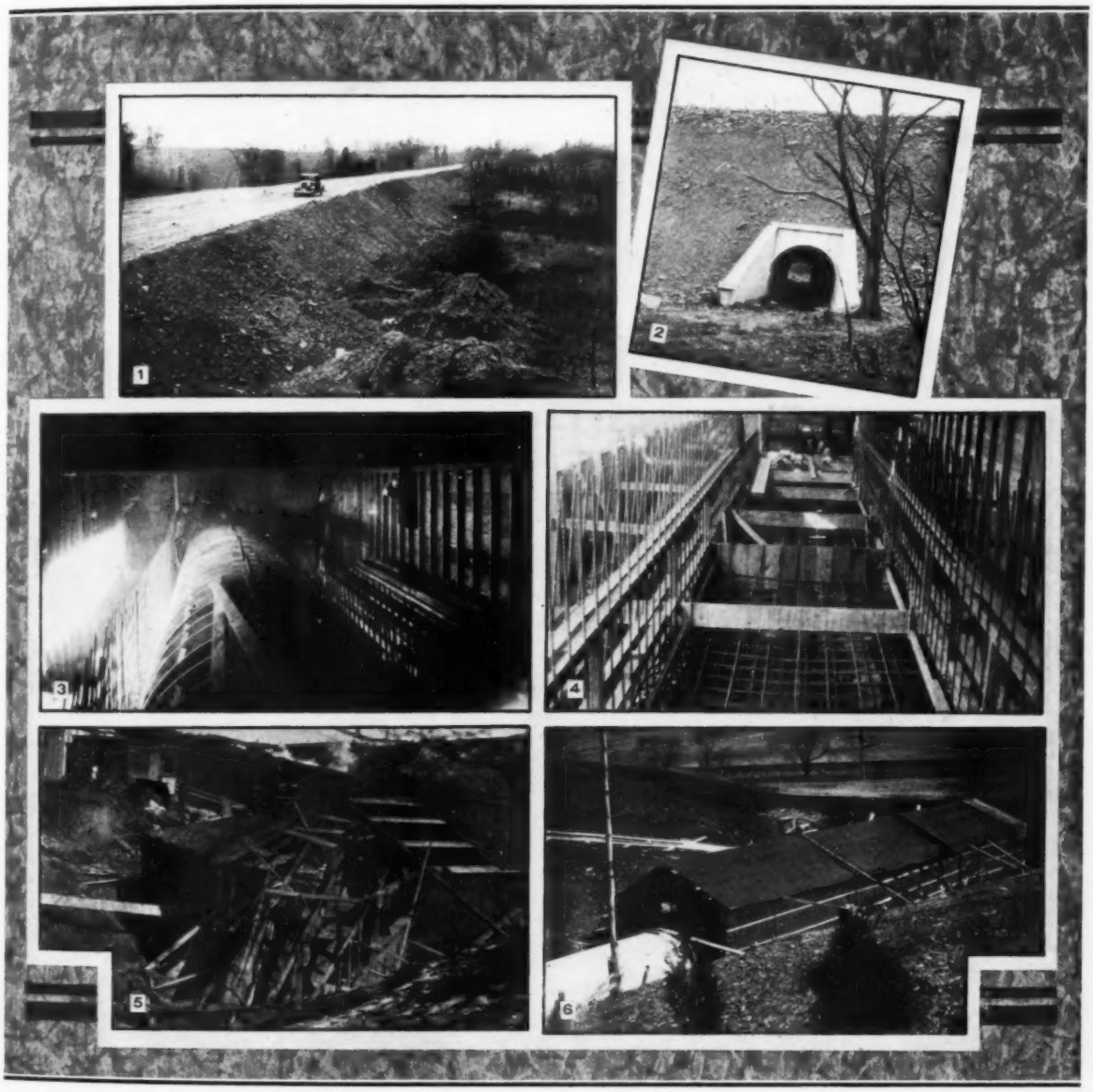
The subcontractor for an arch type concrete bridge of 8-foot span, 184 feet in length, was Joseph Kinzley Co., Hackensack, N. J. This bridge, which was designed structurally to bear the weight of a 35-foot fill, was begun late in December, 1929. Cold weather set in before the excavation had been completed. Under ordinary conditions the bridge contractor would have waited until spring. This, however, would have handicapped the general contractor in his heavy rock excavation and in completing the big fill. An agreement was reached whereby the work went on in spite of the weather.

The cold was intense, the inspection rigid, and the job forced out one construction crew before the excavation was completed. They just quit because it was

cold and another crew had to be put on. No concrete was permitted to be poured at a temperature of under 25 degrees.

The bridge was built in two sections. One half was enclosed until completed and the proper time had elapsed for curing. The enclosure, as shown in the illustration, was then moved over for the second half. Heat of at least 50 degrees was kept up inside the enclosure for 5 days after pouring each set of forms. To meet this condition the interior of the enclosure was kept heated day and night with salamanders using coke for fuel.

The enclosure was framed of 6 x 8-inch sills, 2 x 4-inch 8-foot studs, 4 x 4 plates, 2 x 4-inch ties, 20 feet long, and 2 x 6-inch rafters. The south sides and ends were sheathed from the ground to the plate with 10-inch shiplap. The north side was sheathed only for 2 feet up from the ground. The sheathing was covered with heavy building paper all around. It was roofed over with tarpaulin, so placed that it hung down on the north side so that during the day it could be rolled up to the rafters. This provided both light and accessi-



*THE PEAPACK BRIDGE WHICH WAS COMPLETED IN ZERO WEATHER*

*1. The long fill 35 feet high. 2. The completed culvert beneath the fill. 3. Interior view taken during construction showing the barrel ribs in place for sheathing with 2 x 4's to form the arch of the first half of the bridge. 4. The steel mat in place in the invert ready for pouring the concrete. 5. Pouring the south wing wall in the west end of the bridge. Note the provision made in the enclosure for the wing wall. In the left foreground can be seen the force pump and the line of hose running to the right of the photograph up the hill to the steel drum. The overflow on the ground froze as rapidly as it struck the ground. The hose from the reservoir can be seen crossing over the structure from the right to heating coil No. 1, directly over the pump. The second heating coil is behind the structure between the first coil and the mixer. 6. The enclosing structure over the second half of the bridge. Note the portion of the completed bridge. The sides of the enclosure were covered with building paper and tarpaulins were used for the roof*

bility during working hours. At night the canvas was dropped and tied down.

Not only was care exercised in heating during the pours, but all aggregates were heated. Corrugated pipe 15 inches in diameter was placed in the bottom of the sand and stone piles, and used like the old fire boxes in burning kilns of brick to heat the sand and stone. No steam plant was available and heating water was attempted by taking water from the stream with a force pump and passing it through a coil of 1-inch pipe fitted into a large salamander and heated by a raging wood fire. This did not work out so well on the first pour. The defects, however, were remedied on the next pour. A large drum was placed high on the hill for steady pressure and as a precaution against pump failure during operations. On the first pour the pump stopped, and before it was started again steam pockets formed and blew up the coil. The heating plant was doubled after that by using two salamander coils of 1½-inch pipe. One was heated by wood fire and the other by coke. This solved the warm water problem for the entire job.

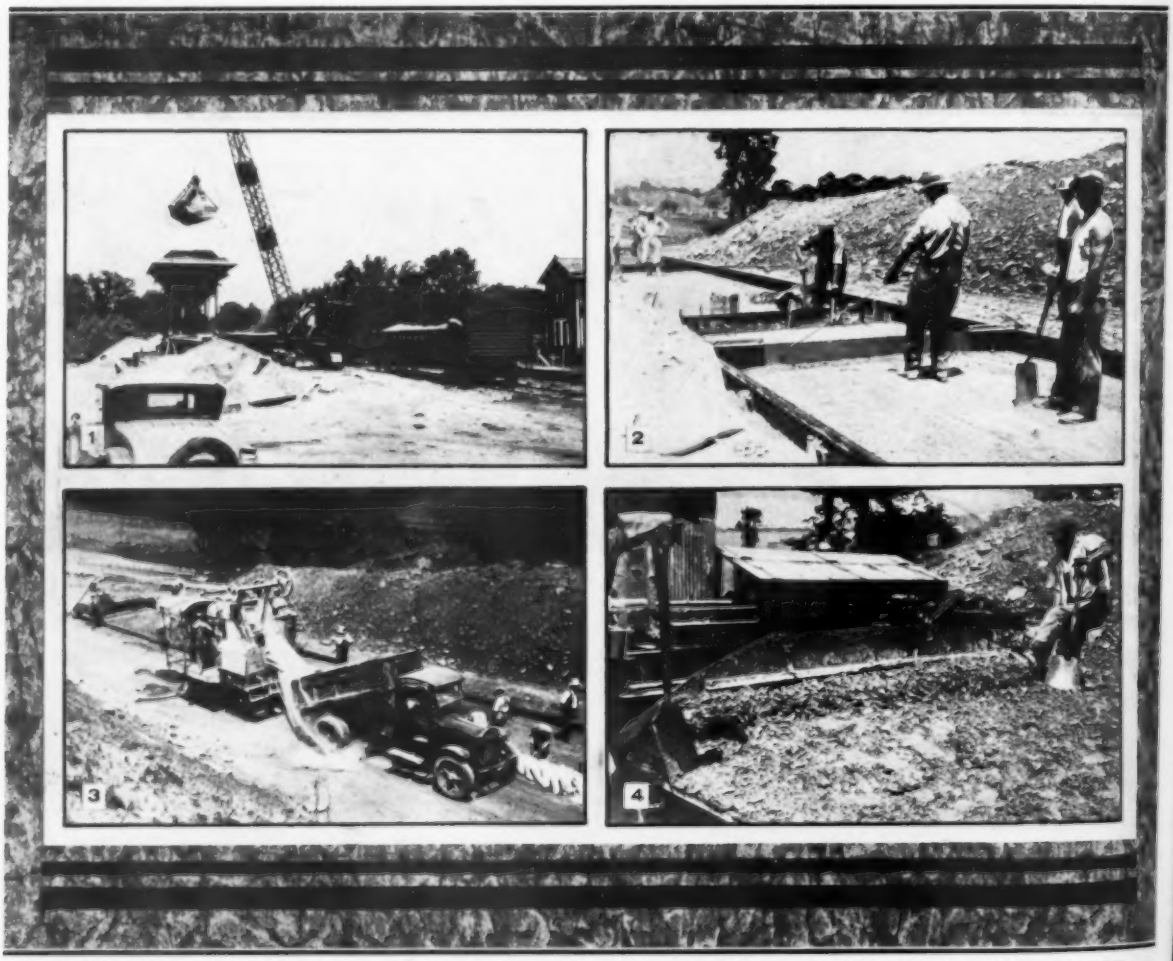
Temperature outdoors for the period of concrete construction ranged from 4 degrees below zero to 70 degrees above. One pour, on February 6, 1930, was made when the temperature was 4 degrees below zero in the early morning. At 1:30 P. M. this pour was made in spite of the extreme cold and turned out in splendid condition.

Concrete was first poured on January 22, 1930, and the last pour made on March 14, 1930. It required 12 pours to complete the job.

The plant used on this project consisted of a Speeder crane for excavation, a two-bag Koehring mixer, Barnes force pump, Humdinger double-acting pump and Caterpillar tractors, which were used to bring in material for miles over boggy fields when trucks failed. On some occasions teams of horses were used for light hauls through the mud or snow.

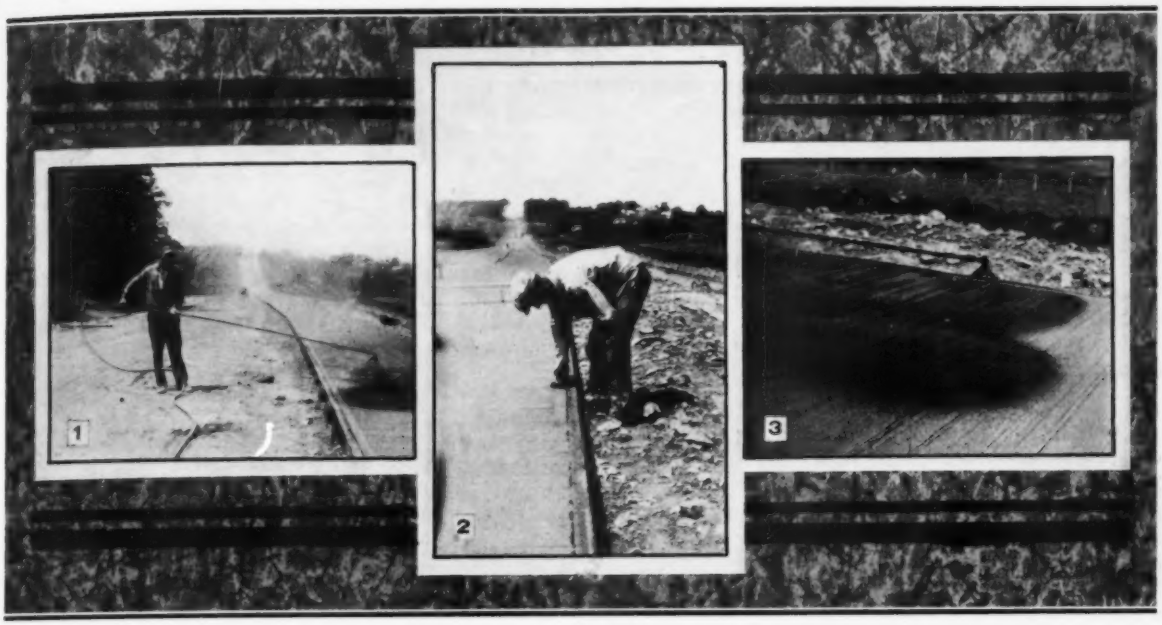
When completed the bridge contained 124 cubic yards of Class B concrete, 120 cubic yards of Class C concrete, and 36,800 pounds of steel. It was not an extensive job, but required patience and perseverance in the face of Nature and its distinctive obstacles. The foreman on the job said:

"Winter concrete work out in the open can be done, but the man who doesn't add 30 per cent over his summer prices will find himself getting experience and taking a loss."



*BATCHING AND POURING THE SLAB ON THE CONSOLIDATED PRODUCTION COMPANY JOB NEAR PEAPACK, N. J.*

1. *The batching plant at Peapack.* 2. *The boiler plate scratch board.* 3. *One of the fleet of Macks delivering a batch to the Rex 27E paver. The Ord finisher is shown at the left.* 4. *Close-up of the Ord strike-off*



*FINISHING AND CURING THE SLAB*

1. *Spraying Curcrete, asphalt emulsion, for curing the concrete slab.* 2. *Hand edging prior to spraying the slab.* 3. *Close-up of the asphalt emulsion spray*

### OTHER DRAINAGE STRUCTURES

Other drainage structures included two 4 x 30-foot box culverts, one 108 feet and the other 165 feet long. There were two bridges, one 55 feet wide with a 14-foot span and the other 140 feet wide with a 10-foot span. There were 105 feet of 42-inch reinforced concrete pipe, 90 feet of 36-inch reinforced concrete pipe, 350 feet of 30-inch reinforced concrete pipe, 600 feet of 24-inch double strength vitrified clay pipe and 750 feet of 18-inch double strength vitrified clay pipe. In addition there were 21 feet of 36-inch cast iron pipe, 300 feet of 24-inch cast iron pipe and 80 feet of 18-inch cast iron pipe.

All of the fill was placed in 6-inch layers and rolled with a Huber gas roller. One of the new features this year has been the cut-off banks for sight curves, leaving a berm beyond the improved shoulders.

### HANDLING THE AGGREGATE

The batcher plant for proportioning the sand and two sizes of stone for this contract was located on a siding at the Peapack, N. J., railroad station. Stone was received from the Morris County Crushed Stone Co., Millington, N. J., and sand was purchased from the same company from its Morris Plains plant. About 12 cars of aggregate a day were unloaded, four of each size. The cars were unloaded by a Koehring crane with a ¾-yard Hayward clamshell bucket, which served the Blaw-Knox bins and weighing batchers. The individual batches were made up of 1,250 pounds of 1½-inch crushed stone, 1,210 pounds of ¾-inch crushed stone and 1,200 pounds of sand. The labor required at the batcher plant was at a minimum, there being one man in the car, one crane man and the batcher man.

### FINE GRADING AND FORM SETTING

So well was the rough grading handled that the fine grading was reduced to a minimum. Two men with two helpers set the Blaw-Knox 9-inch steel forms for the 10-foot strip, keeping them about 800 feet ahead of the paver. A total of 4,000 lineal feet of forms was kept on the job. As soon as the forms were set an Atlantic subgrader was placed on them and the grade cut to a true line, and rolled with a 10-ton Huber gas roller. Any further trimming necessary was handled with a Hadfield-Penfield one-man grader. The total number of men on fine grade, including the operator of the equipment, was 10.

A boiler plate scratch board 9 inches deep, developed by J. A. Farley, Grade Inspector for the State, was used with considerable success on this job. Only one man was required to pull it forward, but its own weight held it close to the grade so that inequalities in the subgrade were quickly noted.

### CONCRETE

The fleet of 4 to 7 Mack trucks which hauled the batches turned through an opening in the forms and backed to the 27-E Rex paver. Just ahead of the paver one man was kept busy cleaning and oiling the forms, one man handled the dumping of the trucks and two men on a cement truck, which pulled up next to the skip, tossed 7 bags of cement into the skip after the batch had been dumped. The bags were immediately opened and emptied.

The paver operator kept things moving at all times to minimize the slacking of production through lost time. There were four men in the pit and two spaders who also struck off the concrete 2 inches below the top of the forms by hand and placed the reinforcing steel. At the paver was one man on fine grade and one man who placed the bulkheads and dowels every 34 feet 4 inches. The bulkhead for placing of the expansion joints was made up of a plate of steel cut at the bottom to the contour of the road and turned over at the top 1 inch, and then down 1 inch, and with a 1½ x 1½ x

⅛-inch angle on the other side to stiffen it along the top. The bulkhead was slotted for the six dowels required across each expansion joint. Paper tubes were placed on the dowels on the side toward the paver, and the supporting chain was placed on the far side of the paver. The bulkhead and expansion joint were supported by three pins on the far side from the paver and two on the near side.

A 10-foot Ord finishing machine was used with an operator and one helper who shoveled to the strike-off and oiled and greased the machine. There were two hand finishers who handled the floating and edging, and one man on the Curcrete machine applying the asphalt emulsion to the surface after finishing for curing.

### WATER SUPPLY

Water for the paver and for sprinkling the subgrade when necessary ahead of the paver was secured from a hydrant owned by Peapack Borough through a 2-inch pipe with taps every 500 feet for the paver hose. Three hundred feet of hose was carried on the paver. This organization was able to lay between 1,000 and 1,100 feet of 10-foot pavement 9 inches uniform thickness per working day.

### PERSONNEL

For the winter concrete bridge work, Robert B. Bicher was Superintendent for Joseph Kinzley Co., of Hackensack, N. J., and Walter R. Ketels was Resident Engineer for the New Jersey State Highway Department. On paving, Harold Dietler was Engineer for the Consolidated Production Co., Hackensack, N. J., of which John Chisholm is Vice-President and General Superintendent. W. L. Braybrooke was Resident Engineer for the State Highway Department.

## Forethought for Raising the Roof

A NOVEL method of providing for future extension was used in a reinforced concrete building at Worcester, Mass., designed by George F. Strehan, of New York City. When the building was constructed two years ago it was carried up two stories with provision for two additional stories at a later date. This addition is now under construction.

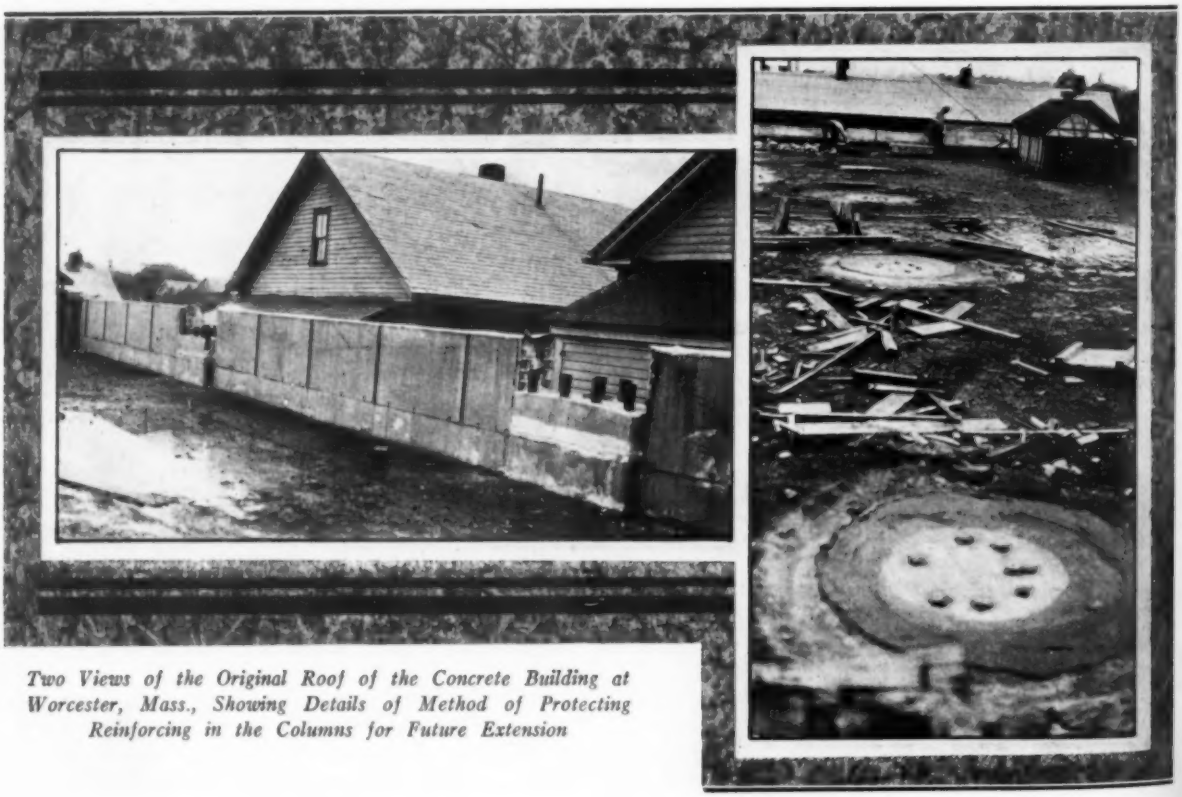
In the original building the top floor, which was to serve as a temporary roof, was finished in granolithic in the usual way and the roofing placed directly on this finish. Where future interior columns were to be carried up, the vertical reinforcing bars of the top story columns were left a few inches below the finished surface. The ends of these bars were milled to give a full bearing to the steel of the future columns.

Before placing concrete, a pipe sleeve with screwed cap was placed over each bar, a stick inside the sleeve holding it at the proper level. This method left only the caps of the sleeve above the finished floor level. These caps were covered by a low mound of concrete and the roofing carried over these mounds. The photograph shows the roof as the construction of the additional stories is about to start. The mounds of concrete have been removed at column locations and the sleeve caps left clear for removal when ready to place column steel.

At the walls the brick curtain wall for the future story was placed with the original construction and served as a temporary parapet. Concrete wall columns were carried half way up this parapet with the capped pipe sleeves protruding several inches as shown in the photograph. Brick was then filled around these sleeves and to the height of the parapet. This brick was easily removed when the addition was started.

With roofing and flashing left in place until protection was furnished by the new addition, only a very little work required to keep the building watertight during construction of the additional stories.

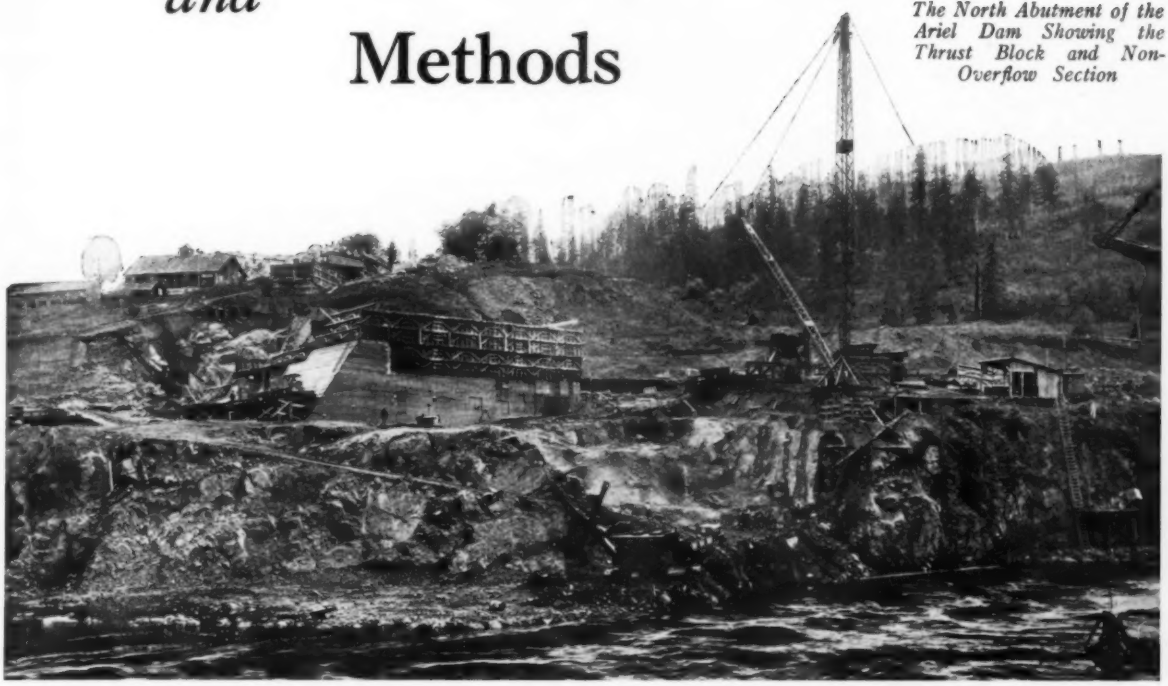
Both original building and the present addition were constructed by the Aberthaw Co., Boston, Mass.



*Two Views of the Original Roof of the Concrete Building at Worcester, Mass., Showing Details of Method of Protecting Reinforcing in the Columns for Future Extension*

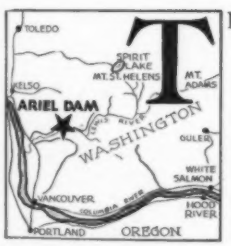
# Material Handling *and* Methods Used *on the* Ariel Hydro-Electric Project *on the* Lewis River, Wash.

*The North Abutment of the Ariel Dam Showing the Thrust Block and Non-Overflow Section*



By

W. A. Scott




THE most important hydro-electric power development in progress in the Pacific Northwest is on the north fork of the Lewis River in the State of Washington. The project is at Ariel power site, situated 17 miles upstream from the river mouth and 12 miles northeasterly from Woodland, the nearest railroad shipping station. The project plans provided for the maximum storage of 220,000 acre-feet of water and, ultimately, the installation of four generating units of the total capacity of 180,000 kw. The cost of this development at Ariel is estimated at $8,500,000.

### The Lewis River

The Lewis rises as a glacial stream on the slopes of Mt. Adams and Mt. St. Helens and flows 110 miles westerly, discharging into the Columbia, 19 miles below Vancouver, Washington. In that distance it makes a descent of 7,900 feet, receiving the waters of five tributaries from the north and five from the south, draining an area of 800 square miles. The annual runoff from this watershed is estimated at 4,000,000 acre-feet and the main stream carrying this volume presents unusual possibilities for storage and regulation. Undoubtedly, these may be utilized by the construction of dams that will create a series of impounding reservoirs, lo-

cated in steps along the course of the stream. The major area of the watershed is mountainous, the stream beds being in deep canyons with steep side walls.

### INTER-CONNECTED CORPORATIONS

The present development at Ariel and that contemplated at Yale power site, 14 miles farther upstream, are projects of the Inland Power & Light Co., a subsidiary of the American Power & Light Co. of New York. Another subsidiary, known as the Phoenix Utility Co., is carrying through all phases of construction work at the Ariel project. The plant when completed will be operated by the Northwestern Electric Co. of Portland, Ore., as lessee. The engineering work is being directed by the engineering staff of the Electric Bond & Share Co., New York.

*Excavation Above the Upper Cofferdam for Channel from Main Stream to the Intake Portal of the Diversion Tunnel*

### GEOLOGICAL FORMATION AT ARIEL

The diamond drill exploration work at the Ariel site was quite extensive, amounting to about 25,000 lineal feet of drill holes. This was carried through by Lynch Bros., Seattle, under the direction of Lyman Griswold, consulting engineer for the owner company. The drill operators used three drilling outfits continuously and three additional ones a part of the time, producing ⅞-inch bores.

Ira A. Williams, consulting geologist, Portland, who studied the formation and made sketches showing geologic cross-sections of the canyon, found that the rocks of both walls and those below the river bed comprised such lava flows as basalt and andesite, and their agglomerate types. The strata have an easterly dip at a low angle. Below the normal bedrock level, a buried channel was found which had been eroded in solid rock. The bottom of this ancient box-canyon section is 110 feet below the present river bed and about 40 feet wide.

### SCOPE OF CONSTRUCTION

The construction work was begun in November, 1929, and the completion of the project is scheduled for August, 1931. The first essential, preparatory to actual work at the dam site, was the regrading of a large part of the highway that extends from Woodland along the north side of the river to Ariel, a distance of 12 miles. Included in this work was the building of three short bridges that would withstand heavy truck haulage. The second was the establishment of offices, store and camp buildings and mess house for the employees, all of which are on the north side of the river, where there is ample room.

This was immediately followed by the delivery of material and equipment required by the construction company for driving a diversion tunnel, building cofferdams, recovering aggregates from the river bed, the construction of a washing and screening plant and a building for the proportioning of materials and the mixing of concrete.

The tunnel was completed and the river diverted through it about June 15. The equipment for excavating and classifying aggregates and for mixing concrete were installed last spring. Since that time the pouring of concrete for the north end sections of the dam has been in progress.

An Ohio 30-ton crane is utilized at Woodland for transferring heavy machines and material from railroad cars to trucks; and a traveling electric crane is to be installed over the power house for lifting and placing heavy parts of the generating units.

### DIVERSION TUNNEL

The diversion tunnel, which was cut through the south wall of the canyon, has a length of 1,467 feet. The cross section area inside the concrete lining is equivalent to that of a 25-foot circle. The bore, which in the rough was about 27 feet in diameter, was finished in horse-shoe section, 25 feet wide at the base and 15½ feet in height up to the springline of the arch. The concrete lining has a minimum thickness of 12 inches. In the tunnel driving which proceeded from both portals, the top heading and bench method was adopted. Ingersoll-Rand air compressors, drift drills and jackhammers were used in the tunnel work. The broken rock after each shot was handled by two Bucyrus type-A, air-operated muckers, mounted upon crawler treads. Each mucking unit was equipped with a ⅝-yard shovel by which the broken rock was loaded into cars, drawn by Whitcomb 3½-ton gasoline locomotives. The explosives used were those of the Puget Sound & Alaska Powder Co., Seattle, makers of the Vulcan brand of powder.

Among the pieces of equipment used on the tunnel were a Ransome grout machine, and a Union Iron Works grout mixer and ejector. These were used first in connection with lining the tunnel. Later they were used in filling grout holes in the dam bedrock.

### COFFERDAMS

The upper cofferdam, by which the stream is diverted through the tunnel, is a timber-crib, rock-filled structure, 1,175 feet long and 45 feet in height above the river bed. There is a distance of over 1,000 feet between the upper and lower cofferdams. The lower dam which prevents back water from entering the area of the dam site is 400 feet long, 35 feet high and of log-crib construction. However, its downstream wall was faced with steel sheet piling, driven to refusal. The upper edge was faced with tongue and groove timbers.

### UNWATERING THE DAM SITE

The river bed area lying between the upper and

lower cofferdams carried a considerable volume of water after the river had been diverted through the tunnel. The water which covered the river bed at varying depths for a distance of over 1,000 feet, was pumped into a 3 x 4-foot wooden flume that discharged below the lower cofferdam. For this work four Bingham centrifugal pumps, with a combined capacity of 11,000 gallons per minute, were installed. Two of these are 12-inch horizontal pumps, each of 4,000 gallons per minute, under a 50-foot head, and driven by a direct-connected motor of 75 horsepower. The other two are 8-inch vertical dewatering pumps, each discharging 1,500 gallons per minute under a 150-foot head and operated by a 75-horsepower direct-connected motor. These pumps were installed and placed in operation late in June.

### Digging Below the River Bed

For several weeks, prior to beginning pumping operations at the dam site, digging below the river bed, to reach bedrock, was carried on with two Clyde derricks, each equipped with a 115-foot mast, a 100-foot boom and a 100-horsepower motor, operating a Williams 2-yard clamshell bucket. One such installation on each side of the river served to excavate over the prescribed area between the rocky banks. In each case the clamshell discharged material into the 7-yard bodies of Linn tractors for haulage to dumps. These digging operations up to June 20, had reached a depth of 45 feet below the river bed.

After the unwatering of the dam site area had been accomplished, the digging was continued by other methods until the box-canyon bedrock was uncovered at a level 110 feet below the river bed. The material handled consisted of sand, gravel and cobbles, with some large boulders. Meanwhile, the pumps were kept in service for handling the seepage water.

The methods employed in excavating through the lower 65-foot section were of two kinds. On the upper and wider section the work was with power shovels, by which the material was loaded into trucks and hauled out over steep grade roads along the sloping sides of the canyon. For this work two diesel 1¼-yard shovels were used and the yardage of the truck loads was governed by the grade of the road from pit to river bank.

In the lower and narrower part the material to some extent was hand-shoveled into 1½-yard skips which were hoisted and dumped by Clyde derricks and disposed of by dump cars. It was anticipated, however, that part of the digging in the deep pit was to be done with derrick and clamshells.

### Operation of Slackline Cableways

The sand, gravel and cobblestones required for aggregates are taken from a riverbed deposit just below the lower cofferdams, which contains an abundant supply for all prospective concrete construction at this site. Besides, the material is well proportioned as to sizes between cobbles and sand. The equipment utilized for recovering material from the stream consists of two Sauerman slackline cableways of 350-foot span, each unit being equipped with a 2-yard bucket, operated from a Sauerman double-drum, geared hoist by means of a 150-horsepower motor through a silent chain transmission belt. The two hoists and the two timber masts are on the north bank where the material is dumped from the two buckets. Each cableway extends from its

*The Approach Channel Showing the Excavation Practically Complete, and at the Left, the Tunnel Portal with the Upper Cofferdam in the Center of the Photograph*

*Placing Concrete with a Wiley-Whirley Crane and Stuebner Bucket on the Last Section of a Fault Trench under the the Spillway Apron*

head mast across the river to a tail tower over which the cables extend to anchorage in the south shore wall. As excavation extends downstream the tail towers are moved in that direction, maintaining a distance of 30 to 50 feet apart. At the head end of each slackline are two Durolite blocks of multiple sheaves and two of single sheaves. Each 2-yard bucket has digging teeth and a cutting lip, its excavating extending to the maximum depth of 35 feet.

The bucket loads of material are dumped into a bunker on the river bank, and pass thence to a Telsmith shaking feeder, 5½ feet by 30 inches, operated by a 5-horsepower motor, the latter being belted to an eccentric shaft that gives the feeder its motion. The feeder discharges onto a slanting 4-inch grizzly, the oversize material feeding into a Telsmith gyratory crusher. The crusher product and the grizzly undersize discharge onto a belt conveyor, carrying this unclassified material.

In the early stages of excavation, a Joshua Hendy hydraulic giant was used in making cuts for the side wings of the dam.

### Conveyor to Screening Plant

The conveyor to the screening plant runs at a speed of 150 feet per minute and delivers the unclassified 4-inch and smaller material to the washing and screening plant at the rate of 3,000 cubic yards per 24 hours. It consists of a Goodyear 24-inch, 6-ply belt, covering a conveyor length of 466 feet between pulley centers, running on an 18-degree incline from the crusher to the washing and screening plant. The belt is operated by a 60-horsepower motor at the head of the incline.

### Washing and Screening

The washing and screening plant, as well as the conveying facilities connected therewith, were designed by H. F. Lincoln and D. W. Cole, construction manager and consulting engineer, respectively, for the Phoenix Utility Co., in cooperation with the Smith Engineering Works, Milwaukee, who supplied and installed the equipment.

The conveyor discharges at the top of the building into a revolving screen, 60 inches in diameter and 14 feet long, operated by a 20-horsepower belt-connected motor. The screen is made up of several sections, as follows: at the head end is a 3-foot blank section, followed by 11 feet of gravel screen section, having 1½-inch openings. Then, on the outer circumference of the main shell are two concentric jackets for pea gravel and sand. The inner jacket, 6 feet long, has 5/16-inch perforations for pea gravel. The outer jacket, 4 feet long, has ¼-inch perforations, through which all sand of ¼-inch-minus passes.

The gravel, between 5/16-inch and 1½-inch minus, passes to stock piles below; the oversize of the 1½-

inch screen section, consisting of cobbles, discharges at the tail end and falls to the cobble stock pile. The sand, up to ¼-inch round, is washed into an inclined trough, leading into a Smith automatic steel sand-settling tank. The sand is then discharged into a twin-screw rewasher and dewaterer. The product of this process, which is clean sand, is fed onto a belt conveyor by which it is discharged to the sand pile below.

All unclassified material from the river is washed through the main screen and jackets by sprays of water from a 6-inch perforated pipe at the screen center, the water used being pumped and piped from the river, above the cofferdam.

Thus, the four grades of aggregate, resulting from crushing, washing and screening, consist of sand up to ¼-inch round; pea gravel size; gravel from 5/16-inch to 1½-inch; cobbles, 1½ to 4 inches, including some slab rock of 4 to 5 inches long. In the proportioning process it is practicable to use pea gravel as a separate grade or mix it with the coarser gravel.

### AGGREGATE CONVEYOR

The stock piles, made up of these grades of aggregate, are undercut by a tunnel, 225 feet long, supported by square sets, with roof and sides of 12-inch x 12-inch and 10-inch x 10-inch timbers. The graded aggregates are moved to the bins of the mixing plant by a 24-inch belt conveyor, 460 feet between centers. The first 225 feet consists of the horizontal tunnel section. The other 235-foot section extends from the mouth of the tunnel to the top part of the mixing plant, running on a 15-degree incline. The conveyor is loaded from the stock piles by means of thirteen 20 x 18-inch Boquod, hand-operated gates, through which one grade at a time is drawn. The conveyor is operated by a 40-horsepower motor, which is belted to a shaft that carries the main driving pinion.

### BULK CEMENT USED

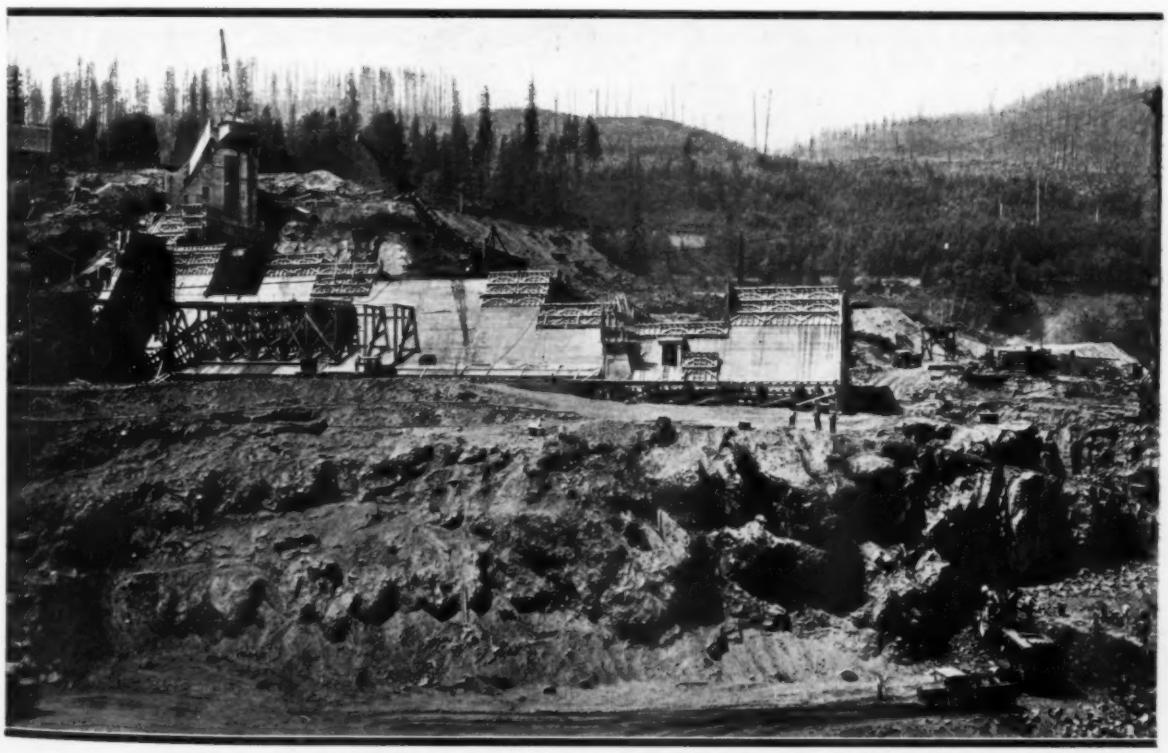
Bulk cement for dam construction is delivered at Woodland in railroad cars. It is moved from cars into a truck loading hopper with a power shovel. For the haulage of cement to the dam, a fleet of 8 trucks is used, the enclosed bed of each truck holding 47 sacks of cement. The cement storage, above the mixing plant, consists of a V-shaped bin 100 feet long with a capacity of 3,800 barrels. The haulage of bulk cement from Woodland to Ariel was awarded to Carl Southworth of Eugene, Ore., who makes a business of handling cement in this form and who has had trucks equipped with enclosed beds for such haulage.

### PROPORTIONING AND MIXING PLANT

The aggregate conveyor delivers its grades of material to the top part of the mixing plant, discharging into a swivel distributing hopper, from which any grade of aggregate may be passed by chute to its designated bin.

On the bin floor are four compartments—three for the aggregates and one for bulk cement. The supply of cement for this compartment is conveyed from cement storage by a 14-inch belt, running on 290-foot centers. Its loading end is below the center of the V-shaped storage bin, the cement being fed onto the belt by two spiral conveyors that discharge at a common point.

On the charging floor, immediately below the aggregate and cement bins, are two sets of batchers, each



*Progress Picture Showing Construction of Ariel Dam, as It Appeared July* 1, 1930

equipped with one weighing hopper for the aggregates and one for cement. Thus, in the proportioning of the materials, 2-yard batches are made up and chuted down to the mixer. Each of the three grades of aggregates, as required, is drawn down to the weighing hopper through air-operated gates; the cement weighing hopper is supplied by a spiral conveyor, operated by a 3-horsepower motor. The predetermined volume of water for each batch is controlled by an overflow gage, the supply being pumped from the stream above the upper cofferdam. Each set of batchers serves one of the two Smith 2-yard mixers. The weighing hoppers and gates are the Blaw-Knox type.

The plant is equipped with three Smith 2-yard mixers, two being operated at a time, by which concrete is supplied for pouring 1,400-yards per day. Each mixer is operated by a 30-horsepower motor, the power being transmitted by a driving pinion and a set of gears.

### Handling the Concrete

The concrete is discharged from the mixers into Stuebner 2-yard bottom-dump buckets, carried on small flat cars drawn over tracks by Whitcomb 7-ton gasoline locomotives to the edge of the dam section that is being poured. The buckets of concrete are there picked up by Wiley-Whirley derricks and poured. The Whirley is equipped with a 3-drum hoist, a 100-foot boom and a 75-horsepower motor, the power being tapped off a 440-volt line from the local substation.

Following the pouring of each batch of concrete on the dam, a gasoline-operated Briggs & Stratton plate tamper is effectively used.

### Design and Dimensions of Dam

The section of the dam that stretches across the canyon proper is a concrete arch structure, 760 feet long at the crest and about 50 feet at the base; 93.5 feet thick at the base and 18 feet thick at the top. This section, which will rise to a height of 300 feet above foundation bedrock, was designed for a curvature on a variable radius from 50 feet at the base to 400 feet at the crest.

The south end of the arch is built into and braced against an excavated cut in the canyon wall. This arch, at its north end, joins onto a concrete thrust block 65 feet high and 115 feet thick at the toe, the base being at a level about 30 feet above the river bed. Extending northerly from the thrust block is the 226-foot spillway section, the crest of which is 35 feet below that of the main dam. This overflow section will be equipped with five Taintor gates each 30 feet high. These gates, at normal reservoir level, are estimated to discharge at the rate of 120,000 cubic feet per second.

The north abutment section of the dam, extending 320 feet out from the spillway, was completed in June. The pouring of the spillway section, thrust block and north section of the arch were completed in July, as was also the south thrust section of arch. The pouring of the principal arch section across the stream awaited the completion of excavation down to permanent bedrock.

### Penstock and Power Plant

The four penstock inlets through the dam will be at elevation 60, or at a level 180 feet below the crest. Plans provide for the installation, ultimately, of four steel penstocks, each of 15½ feet diameter, one of which will be installed within a few months, to serve the initial generating unit of 45,000 kw. The power house will be built immediately below the toe of the dam. It will extend across the stream bed and is to consist of a concrete and steel structure, resting upon an arched foundation. The initial hydraulic turbine will operate under a maximum head of 185 feet.

### Cement and Concrete

The concrete required for all sections of the dam, the power house and tunnel lining amounts to approximately 350,000 cubic yards. The 350,000 barrels of cement necessary for that construction is being supplied by the Pacific Coast Cement Co., Seattle. Besides some of the brand produced at its own plant, this company furnishes cement from other plants, subject to the approval of the Phoenix Utility Co.

In connection with the use of different brands of cement on this job, the practice is not to mix them in making up concrete batches, but to make runs of one brand at a time.

Excavations for the dam and spillway amounted to over 300,000 cubic yards of material and there were 25,000 cubic yards of rock work in the diversion tunnel.

### Personnel

The execution of the work according to project plans was assigned at the outset to the following staff of able and experienced men:

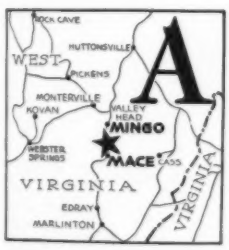
L. T. Merwin, Vice President and General Manager of Northwestern Electric Co., executive officer for the owner company and the construction company; O. L. LeFever, general superintendent of Northwestern Electric, who passes on all permanent equipment for the project; H. F. Lincoln, construction manager, with R. C. Booth as his chief assistant; D. W. Cole, consultant as to the strength of all materials used; Lyman Griswold, engineering representative of Northwestern Electric Co.; E. W. Lazell, consulting chemist in the matter of cement testing.

*The 225-Ton Per Hour Screening Plant of the Phoenix Utility Company with Its Two 2-Yard Sauerman Slackline Cableways Working on Spans of 1,000 Feet*

# Economical Quarry Operation *on a* Short Road-Base Job

***Six-Cylinder Gas Engine Operated Crusher, Elevator and Screens for Limestone Base***

*Chevrolet Shuttle Truck Dumping Stone from Quarry into Crusher*




A STRETCH of 1.8 miles of Project 149-B and C, for which the F. C. Sammons Co., of Huntington, W. Va., was the general contractor, was handled by the Gay-Coleman Construction Co., Ashland, Ky., as subcontractor. The work consisted of furnishing and laying stone for an 18-foot broken stone base, 8 inches thick compacted, and consisting of stone from 4 inches down to 1¼ inches. On this at a later date, under another contract yet to be let, a 3-inch modified macadam top will be placed.

### Quarry Well Operated

With a wealth of limestone available in this country the contractor opened a quarry about ½-mile from Mace, which is located at the south end of the project. A face of 35 feet was used with an overburden averaging 3 feet, which was stripped with a Caterpillar Thirty pulling a Western rotary scraper.

Air for the drilling operations was furnished by an Ingersoll-Rand portable compressor located at the north end of the quarry, adjacent to the screening plant, so that it could be looked after by the same man who attended the power plant for the crushing plant. Holes were drilled with I-R jackhammers to a maximum depth of 16 feet, and shot with Du Pont 40 per cent gelatin dynamite. The blasting was done every night.

As the quarry was located in a cut on the road it was necessary to have available a detour through an adjacent field. As the weather was dry most of the time during this job there was little trouble with the detour. Further, the quarry floor, which was the subgrade of the road, was cleared almost immediately after the shot so that traffic could go through. On Sundays and holidays when the quarry was shut down the road was always cleared to avoid possible trouble with the detour.

### Moving the Rock

A Bucyrus-Erie steam shovel with ¾-yard bucket moved the stone of proper size, loading into two Chevrolet trucks, which shuttled to the ramp over the crusher. When the shots brought down stone that was too large for the shovel to handle the pieces were mud-capped to break them. The contractor figured that it was more economical to mud-cap than to block-hole the pieces, as it took a maximum of two sticks of dynamite to mud-cap, and it would have been necessary to bring down an air line from the top of the face and have a man take half an hour to drill the holes for block-holing.

In the quarry there were 1 driller, who drilled about 250 feet of hole per day, a blacksmith, 3 sledge men, 3 shovelers removing earth that fell from the overburden, the shovel runner and fireman.

### Crusher Produced 250 Tons Per Day

A 15 x 36 Cedar Rapids Universal jaw crusher was

*The Climax Power Plant Put Nicely Out of the Way under the Ramp to the Crusher*

set up at the end of the ramp and was fed through a hopper. The crusher, the Weller bucket elevator and cylinder screens were run by a 125-horsepower, 6-cylinder Climax engine, tucked away under the ramp, where it was out of the way and yet easy to get at for oiling. At the crusher there were 2 feeders, 1 bin man and a mechanic. The whole plant was well laid out and compact, so that there was a minimum movement of trucks to handle the stone to the crusher and from the bins to the road out to the job.

### HANDLING WATER FOR THE SHOVEL

As mentioned the quarry was located in a cut with high sides at either shoulder of the road. The contractor elected to use the side opposite the quarry for a large wooden water tank which could be easily supplied with water by a tank truck. No water was available at the site, as it is almost the highest point in that section of West Virginia. From the tank a pipe was led down and the water supplied to the shovel. This worked very well until the shots were made a little heavier and then the pipe was broken every time. The tank truck was then run into the quarry and water taken on direct and the wooden tank dispensed with for most of the work.

### SPREADING THE STONE

To shape up the subgrade for the 8-inch compacted base the contractor used a Russell Super Mogul grader with 12-foot blade pulled by a Caterpillar Sixty.

### OPERATIONS ON THE ROAD

Hauling the crushed rock from the bins was done by subcontract. The subcontractor used two 2-ton Indiana trucks and dumped with the tailboard partially open to spread the rock fairly uniformly on the subgrade. Four men were used to shovel and fork the stone into place, after which it was smoothed off with an Adams 6-foot grader, pulled by a team. The stone was compacted with a 10-ton Galion steam roller. In order that the stone would be spread uniformly, wood blocks were set up along the edge of the road to guide the hand spreaders.

The base of 4-inch stone was filled with stone from 1¼-inch long, hand cast across the surface and swept into any openings in the larger stone.

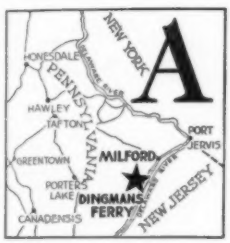
### PERSONNEL

The quarrying operations and the laying of the stone by the Gay-Coleman Construction Co., Ashland, Ky., was in charge of Virgil Thomas as Superintendent. For the State Road Commission of West Virginia, H. C. Roderick was Inspector.

*A General View of the Quarry with the Bucyrus-Erie Steam Shovel*

# Pennsylvania Contractor Uses 10-Foot Strip Construction

## *Rudolph & Delano Adopt Method New in Keystone State and Also Test Slab for Smoothness With Road Surface Rater*




AN old shale and dirt road bound with oil south of Milford, Pa., on the way to the famous Delaware Water Gap, was regraded, widened and paved with a 20-foot, 9-7-9-inch concrete slab last summer by Rudolph & Delano, of Tamaqua, Pa., for the Pennsylvania State Department of Highways. This particular contract called for half width construction. It is, however, the policy of this company to pave all their contracts in this manner. The contractor also made use of a local sand bank, opening a source of sand, and used stone from a job completed earlier, south of this project where 4,000 yards of ledge suitable for aggregate had to be removed.

### 85,000 Yards Handled in Grading

Grading operations were started about January 15, 1930, and involved the handling of 85,000 yards of unclassified excavation of which 25,000 yards was cobble rock in gravel banks. This stone, the resultant of erosion, is very hard and had to be broken down by hand sledging to less than 8 inches in diameter so that it could be used in the 8-inch layers required in all fills. At times as many as 50 men were required to hand-sledge the stones. The average grading crew consisted of about 25 men, including all the machine operators. Some of the larger of the cobbles were mud-capped to reduce them.

In the figure of 85,000 yards of excavation is included about 40,000 yards of borrow, as the cuts were not sufficient to take care of the fills. Two Lima 101 gas shovels were used on the work, one of them for only 2 weeks during the peak of the excavation. The shovels loaded a fleet of 6 to 12 International and Mack trucks, which had an average haul of 2,000 feet. All the fill was spread by a Caterpillar Sixty and bulldozer, dispensing with any heavy grader work on the rough grade operation. The fills ran from 3 inches to 20 feet, and all cuts were light. All fill was rolled with a Buffalo-Springfield 10-ton gas roller.

### Drainage Structures

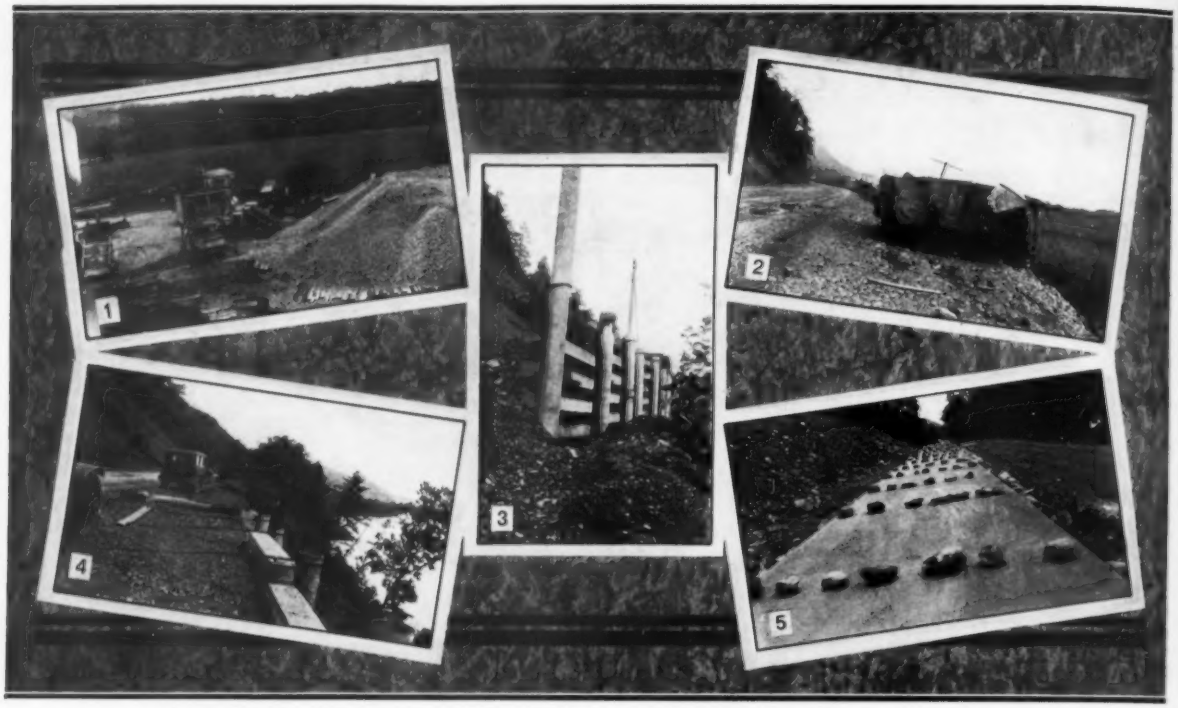
The drainage was taken care of by 6 cast iron culverts from 15 to 18 inches in diameter and about 50 feet long each. A number of concrete pipe culverts of similar sizes and average lengths were used. There were several small concrete bridges built throughout the project during the rough grading operations. Credit is due the contractor for the remarkably good subgrade left for the traveling public throughout the entire length of this contract. The abundance of finely broken shale at several places along the right of way was used freely to give a suitable surface to the road, as there was no detour available without excessive added distance.

### Well Casing and Cribbing Holds Fill

A peculiar problem presented itself at Cave Bank, where the same contractor had had difficulties with a loose shale bank burying a Northwest and an Erie shovel two years ago when the old right of way was being graded. At the outer edge of the road the ground slopes off sharply to the bank of the Delaware River. In order to retain this bank at the elevation decided upon for the highway concrete, piles were used with concrete cribbing. The State had driven a number before the present contract was started, but this work included the installation of 42 piles in a distance of about 400 feet. The well casings were driven to a depth of 50 feet, and then a 6-inch I beam was inserted and the whole concreted. The 10-inch diameter casings were anchored across the road to rock or to dead men where rock was not available. This construction is illustrated in two of the photographs accompanying this article. Concrete beams 10 feet long and 12 x 12 inches in section were laid up as cribbing behind the well casings.

### Stone Supplied from Earlier Job

The stone for the concrete on this contract was supplied from a ledge of bastard limestone, 4,000 yards of




*FEATURES AND METHODS ON A ROAD JOB ALONG THE DELAWARE RIVER*

*1. The stockpile of stone adjacent to the batcher plant. The sand pit and sand washing plant were at the left. 2. A stockpile of reinforcing fabric on the shoulder protected from rain by opened calcium chloride sacks. 3. Well casing piles and cribbing at Cave Bank. 4. Top view of cribbing showing method of tying piling to dead men on the far side of the road. 5. Typical cobbles which were encountered all the way along this job and necessarily removed from the subgrade. Many were used as barriers on the completed strip to keep traffic from using pavement during the curing period*

which was in the right of way of an earlier job about 11½ miles south of the sand plant, which was located 3½ miles from the south end of the job. The ledge was drilled with two rented Keystone well drills and shot with 40 and 60 per cent Trojan dynamite, using 5 x 17-inch sticks. The stone was loaded to trucks by a ¾-yard Erie steam shovel and hauled to the crusher, a No. 6 Good Roads unit, which was supplemented by a Good Roads No. 4 crusher for the oversize stone. The run of crusher stone was well within the limits of the specifications, running from ⅝-inch to 2¾-inch stone.

The stone was hauled from the crushing plant to the sand plant, and stockpiled on the side of a hill on the south side of the batcher. The hill was planked to protect the stone.

### THE SAND PLANT

The sand plant was located 3½ miles south of Dingmans Ferry, the south end of the contract. The production of the sand was done by subcontract under the direction of the general contractor. An Erie steam crane with a 40-foot boom and Williams ¾-yard clamshell bucket dug the loose sand and gravel from the bank after it had been stripped of all loam. The clamshell delivered the material to a hopper, which fed a belt conveyor leading to the bucket elevator of the Universal sand washer. The washed sand was stockpiled just south of the washer and at the north side of the Blaw-Knox batcher plant.

A Lima 101 gas crane with a 45-foot boom and 1¼-yard clamshell handled the stone and sand from stockpiles to the batcher. The weighing batchers delivered batches averaging 1,890 pounds of stone and 1,236 pounds of sand to the fleet of trucks, which at a maximum included eighteen 3-batch Maccars and Mack trucks of 3½ tons capacity each. All the batch trucks were equipped with dual pneumatic rear tires.

The Vulcanite cement, hauled 9 miles from the most convenient freight siding, was loaded onto the batches, 6 bags per batch, at a cement platform about 300 feet from the batcher. Two men handled this work.

### PREPARING THE FINE GRADE

The surface of the old oil-bound road was ripped up by a Buffalo-Springfield gas roller with a scarifier, and then the subgrade was shaped with a No. 4 Russell patrol grader and rolled with a 3-ton Austin Pup roller, and the Buffalo-Springfield where necessary. The Austin was used throughout the work between the forms for the final compaction.

### "KEEP THE FORMS 2,000 FEET AHEAD OF THE PAVER"

The motto of the organization was to keep the forms at least 2,000 feet ahead of the paver, and there were many days when the forms and grade were ready over 3,000 feet ahead. The contractor had about 4,000 feet of Blaw-Knox 7-inch forms on the job, and bought 3,500 feet of new 9-inch Blaw-Knox forms for this job. The form setting crew consisted of the head form setter and 6 laborers. They maintained a fine line for the forms and were followed by 2 men resetting forms ahead of the paver. These men realigned any forms

which had been knocked out of line by the trucks and reset the forms which had been removed to permit the batch trucks to turn on the shoulder.

A man was kept ahead of the paver to oil forms and do the innumerable odd jobs that are necessary, such as picking up tools and odds and ends that get onto the subgrade.

### PLACING THE CONCRETE

After the batch trucks had turned through the forms and had backed toward the paver, the specifications required that the cement on the truck next to that being dumped at the skip was the only one on which the bags could be emptied. The requirement is not as strict as in some States, where the cement may only be dumped into the skip and does obviate the delay entailed by the more rigid requirement. One man cut the wires on the bags and two others emptied the bags on the respective batches. At the paver one man dumped the trucks into the skip. The operator of the 27-E MultiFoote paver delivered an average between 1,500 and 1,600 feet of 10-foot slab a day with the organization described with 6-bag batches. A Lakewood steel pin subgrade tester was pulled along the forms by the paver. Where the grade was high it was cut by the 2 men who attended the tester. When the grade was low the contractor did not fill in but took the loss of the extra concrete.

There were 4 pit men and 2 spaders, who also handled the placing of the National Steel Fabric welded mesh reinforcement. The steel fabric was hauled 18 miles by a truck and 4 men and stockpiled along the road from which it was distributed as needed. Two men placed the center strip against the 7-inch form and inserted the dowels which bond the two strips. The center strip in this type of construction was used over and over, so that the contractor had only about 1,750 feet of the National Steel Fabric Co. strip on the job. The steel was removed as soon as the forms were taken out and moved ahead with them. A truck and 10 laborers with a foreman removed the forms the day following pouring, the entire job being completed by 10 in the morning.

One man on the paver took care of the calcium chloride solution, making it from the bags of Solvay calcium chloride which were distributed along the shoulder. An automatic device was used for applying the right amount of the solution to each batch. A small tank with the correct capacity was attached to the paver skip. When the skip was down the solution would run by gravity into the measuring tank from the solution barrels on the paver platform. When the paver skip went up the solution would run into the drum of the paver, as a check valve prevented its return to the solution barrels.

### FINISHING OPERATIONS

The initial finishing of the slab was with an Ord finishing machine manned by one operator. The pit men kept the strike-off well loaded with concrete to prevent any low spots in the slab. Following the machine were 2 surface hand finishers and 2 edgers who straight-edged the slab, corrected any high or low spots with long handled lutes and then belted the surface with a canvas belt.

Immediately after the belting the surface was covered with burlap by two men and the covering left on for 24 hours. Three men sprinkled the burlap during the entire period. The state inspector kept close tabs on the removal of the burlap, and each hour permitted the portion which was poured 24 hours before to be uncovered and the burlap taken ahead.

### A ROAD SURFACE RATER USED

The contractor bought an Olsen-Andrew road surface tester for determining the high and low spots in the pavement. The machine consists of a double frame carrying three hardened steel wheels. The two end wheels run in fixed axles and the center wheel is free to ride on the pavement. It shows by an indicator on a scale above the frame whether the slab is high or low and by what amount at the point where the center wheel is resting.

### WATER SUPPLY

The water supply for the paver and for the sprinkling of the slab was supplied from nearby streams by a Domestic triplex pump under a pressure of 200 pounds. A 2-inch pipe line was used and taps installed every 200 feet for the paver hose. A 175-foot hose was carried on the paver.

As a means of protecting the paver hose and saving water the paver carried a pressure reducing valve set for a constant pressure of 90 pounds. This prevented a drop in the pressure at the paver with the consequent lower flow when a sprinkler hose was opened, and thus insured a constant stream at the paver for each batch.

### COMPLETING THE SHOULDERS

The project had three intervening sections of old 18-foot concrete which were not disturbed. The new slab, which was started July 1, and completed with the shoulders on September 1, was made to conform to the old slabs at the junctions. The present 20-foot concrete has 8-foot shoulders, while the older portion has only 5-foot shoulders. The new shoulders were built by an Austin grader pulled by a Caterpillar Sixty. Where there was not enough earth on the shoulders to shape up borrow was brought in and worked up by the grader. The shoulders were rolled by the Austin Pup.

### PERSONNEL

This concrete project was built by Rudolph & Delano, Tamaqua, Penna., with J. A. Gaynor as General Superintendent and L. P. Harris as Superintendent in charge of grading. For the State Department of Highways, "Doc" Almony was Senior Inspector.

## Labor Savers are also Cost Cutters on a Viaduct and Bridge Job

(*Continued from page 56*)

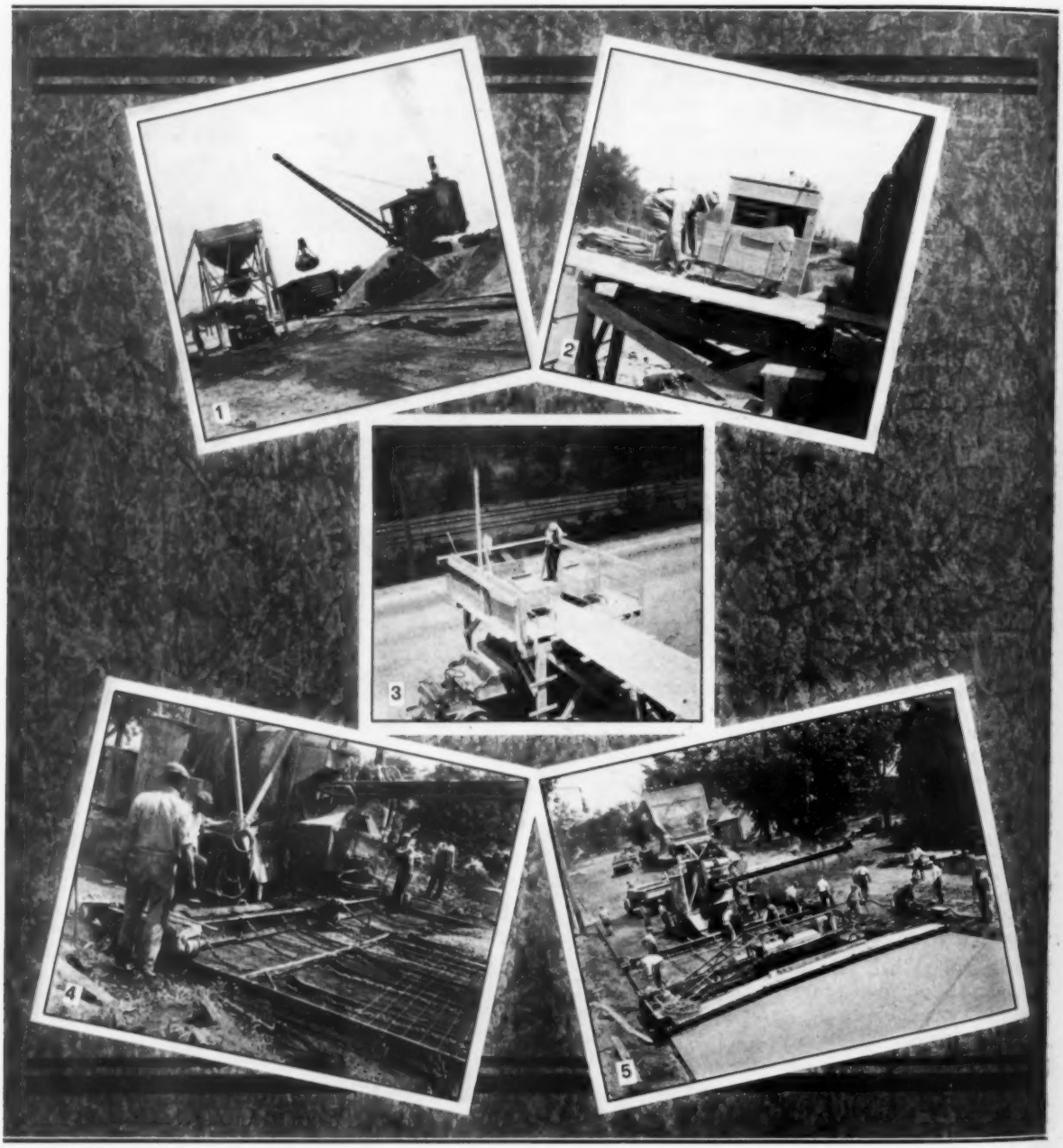
outlined it was possible for the contractor to set up the forms and reinforcing and pour a span a week on the viaduct. On the bridge spans a span in two weeks was the average, although there were some that were handled in one week's time.

### PERSONNEL

The contractor for the entire work was M. A. Gammino Construction Co., of Providence, R. I. The work was done under the direction of John Smith, Division Engineer, with L. H. Beebe as Resident Engineer.

# A Picture Story of Concrete Paving

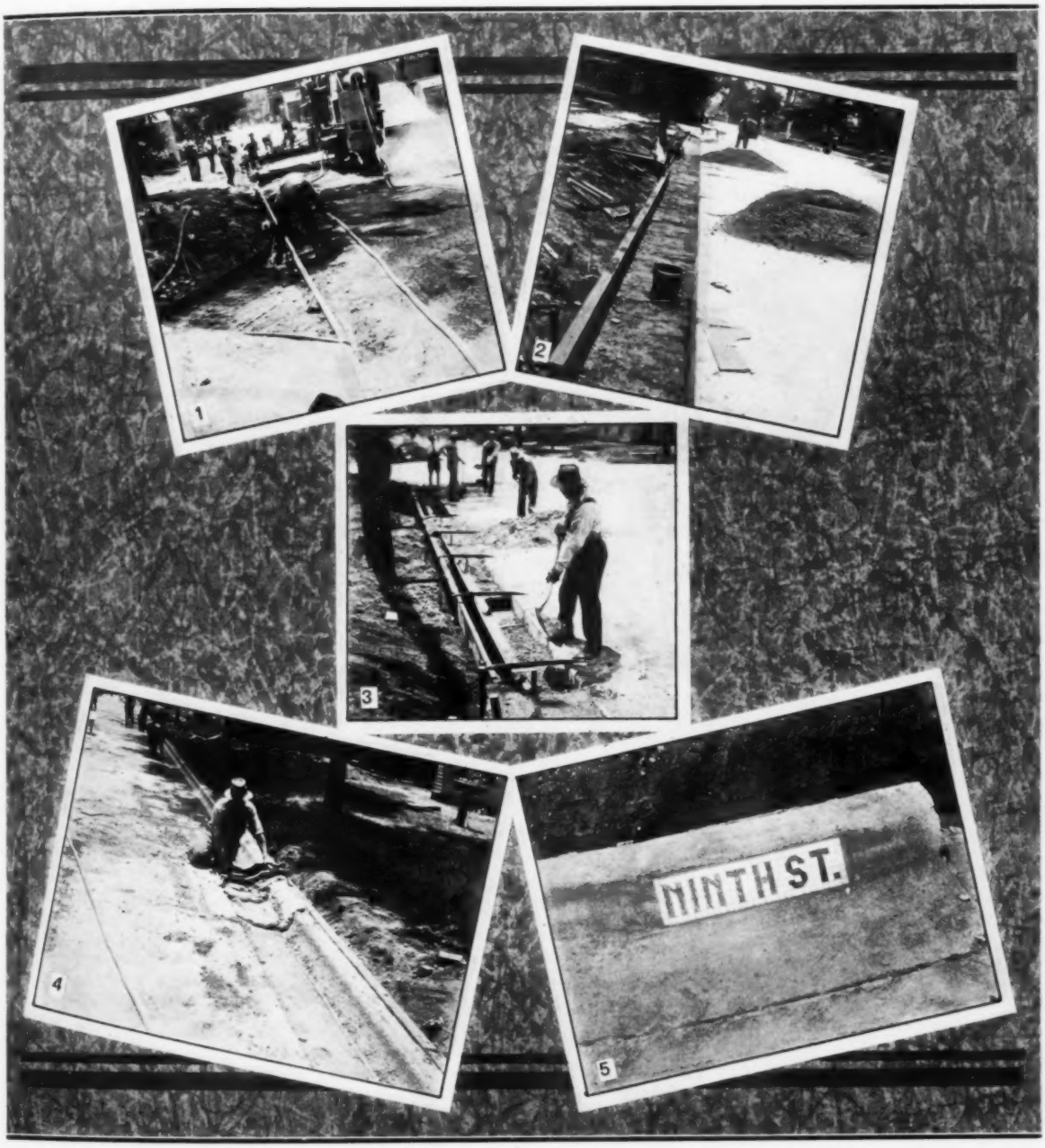
## *A 120,000-Yard Paving Job Used Bulk Cement and Mechanical Finishing*




1. *The aggregates were proportioned and measured by volume in a central batching plant located two miles from the city at the site of a commercial gravel pit.* 2. *Bulk cement was received in box cars. Three men shoveled it into boxes carried on hand trucks. Two men wheeled it to the motor trucks, stopping to weigh it on a platform scale.* 3. *Hoppers set in the floor of the cement runway held the batches of cement until the two-batch motor trucks arrived. The boxes on the hand trucks had the gates in the front end to facilitate dumping.* 4. *As the curb and gutter was built last, regular steel road forms were set for the pavement slab. A heavy subgrade template with a cutting edge ran on the forms and assured proper subgrade elevation.* 5. *A 27-foot finishing machine struck and compacted the pavement, running on the 9-inch steel side forms. The parts to convert the finisher from an 18-foot to a 27-foot width cost $1,100, a small sum when it is considered that the equivalent of nearly three 10-foot strips was finished in one operation.*

# in Pekin, Ill., By Jansen & Schaeffer

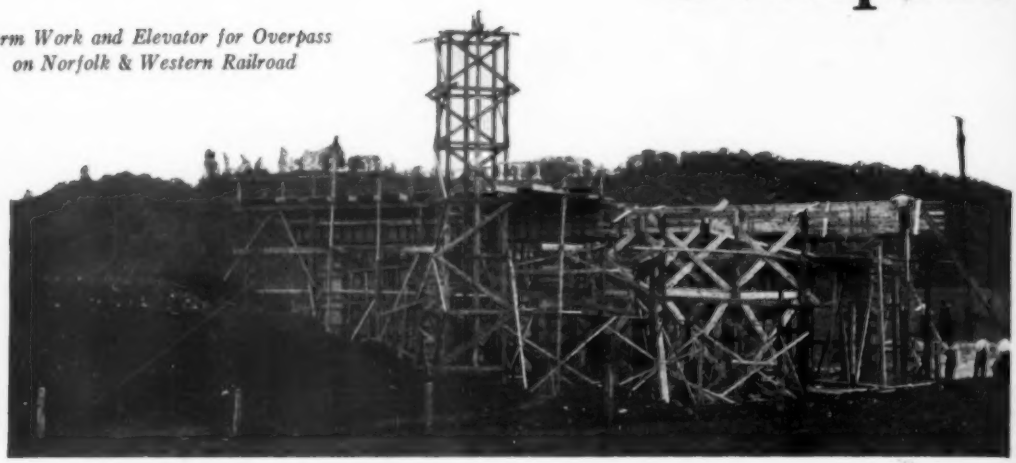
## *The Concrete Curb and Gutter Were Built After the Pavement Was Opened to Traffic*




1. *Forms were run through the intersections and the mechanical finisher handled all but the triangular sections along the curved curb. These were finished by hand. The pavement on cross streets was done first and was stopped at the gutter apron line leaving a gap 27 feet wide so that the mixer could later place the balance of the intersection without riding over the concrete.* 2. *The curb and gutter were built last after the pavement was opened to traffic. Tie-bars were used to connect the slab and the gutter. The concrete was mixed at a central plant and dumped on the slab at measured intervals.* 3. *Both back and face forms for the curb and gutter were of steel, the steel clamps being permanently attached to the face forms but rested on the back forms and the pavement slab. The division plates were spaced at* 10-*foot intervals.* 4. *Concrete for the body of the curb and gutter was proportioned* 1:6 *using an artificially graded mixture of sand and pebbles. A top course of* 1:2 *mortar, mixed by hand in a mortar box, was spread on with a mule.* 5. *Street names were set in the faces of the curb at intersections.*

# Paver Poured Overpass

*Form Work and Elevator for Overpass on Norfolk & Western Railroad*



## *Longley & Co. Lexington, Ky., Built Overpass for Norfolk & Western Railroad near Chilhowie, Va.*

PAVERS are built to move around on their crawlers, but usually the motion is continuous in one direction for the length of the paving job on which the machine is in use. Longley & Co., contractors for the 5-span overpass for the Norfolk & Western Railway, about 1 mile west of Chilhowie, Va., on U. S. Route 11, used a Jaeger 14P paver with high-lift skip for pouring all the footings and the columns for the entire structure.

The work for the overpass was started on April 18, the contract having been awarded about April 5. It was completed by July 15. In accordance with the agreement existing between the State and the railroad the latter let the contract and supervised the construction, while the cost was shared equally by the two parties.

The new location of the highway places the overpass at a skew of 37 degrees and 30 minutes with the railroad. The spans are 40 feet long, except for the single span over the tracks, which is 55 feet. The railroad is single track at present, but the 55-foot span will permit double-tracking at any future time without interfering with highway traffic and at a minimum of expense .

### Footings Poured Direct

Excavation for the footings was carried to a depth of about 3 feet and then the forms built. The space between the footings was such that it was possible to maneuver the paver close to them with the bucket arm extending out over the forms. Thus the buckets of concrete were run out and dumped directly into the forms, eliminating all rehandling. The east footings were poured first, then the west footings and then the paver again moved over to the east side of the track and the east pedestal poured.

Following this the forms for the east columns and the west pedestal were set up and the latter poured first. Then the paver was moved over to the east side and all the concrete work there completed, so that the column forms could be removed and reused for the west columns.

### Concrete Buggied and Elevated

For the placing of the concrete in the pedestal it was necessary to buggy it up short ramps. Two or three men with buggies handled this work with sufficient speed to keep the paver busy. For the columns the concrete was buggied to an elevator run by a Fordson tractor equipped with an Ersted hoist. This method proved very economical and speedy enough to satisfy everyone.

Aggregate for the job was trucked from the Marion, Va., quarry, and the sand was shipped in by freight from Petersburg, Va., to Chilhowie, Va., and trucked out one mile to the job. Louisville Speed cement was similarly received by freight and trucked out.

The concrete received a 1¼ to a 1½-minute mix, and was proportioned about 1:3:5 or 1:3:4.1 with a specified water-cement ratio and a slump of 3 to 4 inches. The resulting concrete gave a test of 2,400 pounds in 7 days, or about 3,800 pounds in 28 days.

(Continued on page 107)

A Section of
CONTRACTORS
AND
ENGINEERS MONTHLY
Devoted to
News of Consultants
in the
Civil Engineering Field

The Consulting Engineer

September, 1930
New York
Vol. II, No. 3

# Progress in Sewage Works Design Visualized

*Office of Alvord, Burdick & Howson, Chicago, Ill.*

THE Aurora, Ill., sewage disposal plant, built for the Aurora Sanitary District, is designed to serve 65,000 people. It is of the separate sludge digestion, sprinkling filter type and embodies several novel features.

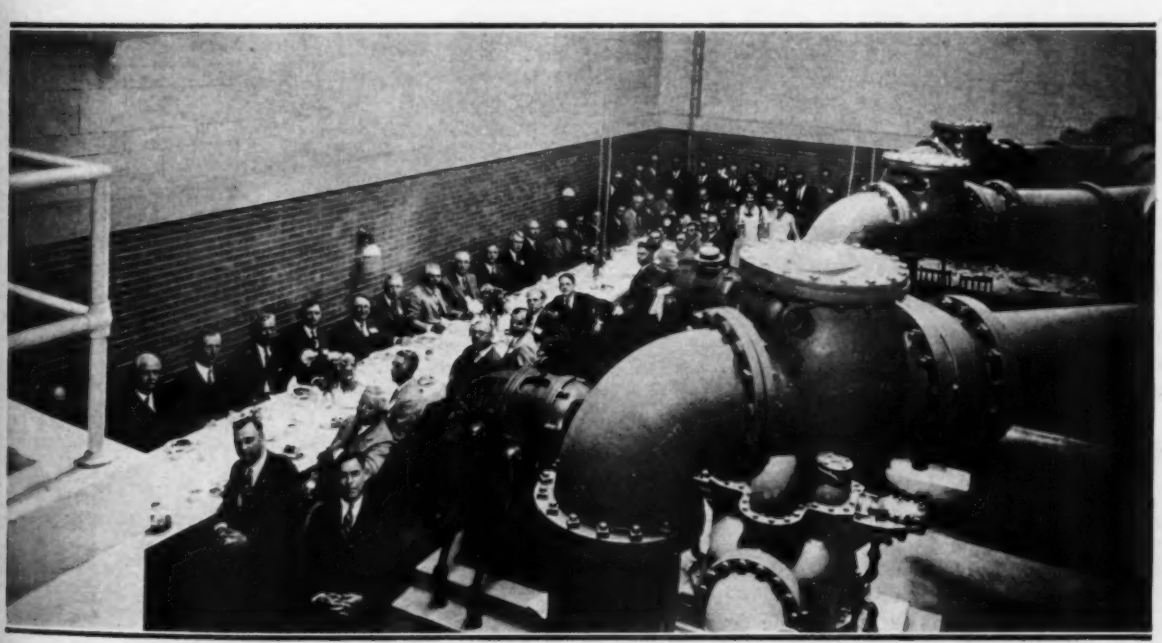
There is an automatically operated, mechanically cleaned bar screen, the cleaning mechanism being actuated by a differential in head on the two sides of the screen due to the material deposited on the screen. There is a mechanically cleaned grit chamber embodying the washing of the organic matter from the grit and its delivery to cars. The settling tanks are equipped with Dorr clarifiers.

The separate digestion tanks are equipped for gas collection and temperature control. The gas is burned under hot water boilers and the hot water recirculates through the sludge tanks and also used for heating the building. The plant is developing approximately 0.8 cubic foot of gas per capita contributing sewage per day.

The sprinkling filters consist of 3.6 acres of beds, subdivided into four units. The plant also includes sludge beds of the standard open type and other appurtenances common to all plants of this type. The site of the plant is between two arterial highways separated about one-quarter of a mile. Considerable attention was, therefore, paid to architectural treatment and landscaping.

The accompanying picture was taken in the pump room immediately adjoining the sewage tanks of the sewage treatment plant which was designed by ALVORD,

(*Continued on page 87*)



*Luncheon Being Served in the Pump Room of the Aurora Sewage Treatment Plant*

# The Consulting Engineer

*A Section of*

Contractors and Engineers Monthly

470 Fourth Avenue, New York

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THEODORE REED KENDALL, Editor
MYRON MACLEOD, Advertising Manager

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## Water Supply and Sewerage Projects

REPORTS on water supply for Regina, Saskatchewan; Bethel, Conn.; Farmington, Conn.; Long Island Water Corp.; Berkshire Industrial Farm, Canaan, Conn.; Workmen's Circle Sanatorium, Liberty, N. Y.; reports on sewerage and sewage treatment for Bethel, Conn.; and Berkshire Industrial Farm, Canaan, Conn.; and final plans for sewerage and sewage treatment for Princeton, N. J., and Utica, N. Y., are being prepared in the office of NICHOLAS S. HILL, JR., Consulting Engineer, 112 East 19th Street, New York.

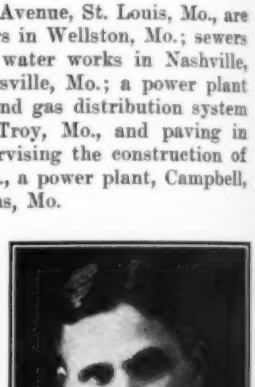
This firm is also supervising the construction of a 10,000,000-gallon water filtration plant at the junction of the Raritan and Millstone Rivers for the Elizabethtown Water Co., Consolidated; a 2,000,000-gallon water filtration plant at Ossining, N. Y., and the enlargement of the sewage treatment plant and the development of new water supply for the Berkshire Industrial Farm, Canaan, Conn.

## Consulting Briefs

**Ernest B. Hussey**, 1311 Alaska Building, Seattle, Wash., as Chairman of the Seattle Terminal Board, is working on plans for a unification of all the railway terminals in Seattle and its immediate vicinity. Mr. Hussey was recently retained by the City of Seattle and the Port of Seattle to prepare for the joint hearing before the Interstate Commerce Commission and the Washington Department of Public Works in regard to complaints against the railroads' switching practice in Seattle. Miles E. Clark, principal Assistant Engineer of Mr. Hussey's staff, is engaged on this case.

**Russell & Axon**, 6200 Easton Avenue, St. Louis, Mo., are preparing plans for storm sewers in Wellston, Mo.; sewers for Millstadt, Ill.; sewers and water works in Nashville, Ill.; a power plant in Caruthersville, Mo.; a power plant in Hayti, Mo.; a power plant and gas distribution system for Vinita, Okla.; paving at Troy, Mo., and paving in Rolla, Mo. They are also supervising the construction of a sewer system for De Soto, Mo., a power plant, Campbell, Mo., and paving for West Plains, Mo.

**George B. Gascoigne**, 1140 Leader Building, Cleveland, Ohio, is at present engaged in the preparation of a report on water supply for the Village of Hudson, Ohio.



*George B. Gascoigne*

**Robert C. Strachan**, 136 Liberty Street, New York, recently prepared an article "Suspended Cables with Large Sags" for discussion by the American Society of Mechanical Engineers. This article presents some new and interesting methods of calculation as applied to bridge construction and will appear later in the *Transactions* of the Society.

**Fisk & Roberts**, Consulting Engineers, 82 Beaver Street, New York, have been engaged by the Board of Public Utility Commissioners of the State of New Jersey to appraise the bus property of the Public Service Co-ordinated Transport, Inc. This appraisal is being made as a result of the company's recent application for rate increases and involves the valuation of approximately 2,500 buses and auxiliary equipment. It is the first large-scale bus appraisal to be made in this country.

**Edgar Boyd Kay**, Consulting Engineer, 323-324 Bond Bldg., Washington, D. C., recently returned from Europe where he attended the International Hygiene Exhibition and World Health Congress at Dresden, Germany, to which he was appointed a delegate by the American Public Health Association. He also visited other points in Germany and took an extended tour through Austria, France, Switzerland, England and Scotland.

**Clark E. Jacoby Engineering Co.**, Engineers, Kansas City, Mo., have moved from the Interstate Bldg., to 908 Fairfax Bldg.

**Parsons, Klapp, Brinckerhoff & Douglas**, Engineers and Managers, New York City, have moved their offices from 84 Pine Street to 142 Maiden Lane. Members of this firm are William Barclay Parsons, Eugene Klapp, Henry M. Brinckerhoff, Walter J. Douglas and John P. Hogan.

## Simplified Mensuration Rules, and Theory of Engineering Models

*B. F. Groat*

OF interest to the engineering profession is the discussion by B. F. GROAT, 20 Chapel Street, Brookline, Mass., of the paper "Effect of Turbulence of the Registration of Current Meters" by Nagler and Yarnell. This discussion, while relating to current meters, nevertheless gives results of a general formula demonstrated by Mr. Groat, of which such rules as Simpson's and others may be made to appear as special cases, while certain new formulae are adduced for areas, volumes, and averages generally of use in statistics. These new formulae are of universal applicability in engineering estimates and give results in the simple form of the arithmetical mean of the measured ordinates, thus saving much calculation. This will appear in the *Proceedings* of the American Society of Civil Engineers.

An early issue of the *Proceedings* of this Society will also contain an article by Mr. Groat dealing with the theory of similarity and models. This is a concise treatise based on data of a former paper by the author. The article points out that Newton's law applies to all forms of dynamic models, a fact not generally understood, and an unduly propagated misconception in this regard is disclosed, traced to its source, and explained. It states that models can be built to specification as to materials and their properties so as to perform with theoretical exactness, and suggests that materials, including fluids, should be sought, made or arranged, so as to adapt them especially for service in models, thus opening a new field in engineering.

## Notre Dame Stadium Nearing Completion

WORK on the Notre Dame Stadium is being rushed towards completion by the OSBORN ENGINEERING Co., Cleveland, Ohio. The concrete for the stadium is being laid in sections to permit of the greatest rapidity with the least outlay for forms and labor. The design is marked by simplicity and provides for the greatest comfort of the spectators. The shape is that of a letter O, with seats surrounding the field and with the first row of seats much nearer the playing field than is usual in the design of athletic fields. Cleveland's new Municipal Stadium was also designed along similar lines by this company.

## Plans for Sewage Treatment Plant

A SEWAGE treatment plant for the joint trunk sewer of the City of East Orange, Township of Hillside, Town of Irvington, Township of Maplewood, Township of Millburn, City of Newark, Borough of Roselle Park, Village of South Orange, City of Summit, Township of Union and Town of West Orange, N. J., is being designed and will be built under the supervision of ALEXANDER POTTER, C. E., 50 Church Street, New York. The plant, which has been under consideration by the boards of the various municipalities for some time, will be located near the Shore Line of the Central Railroad of New Jersey not distant from the Goethals Bridge. The plant will contain mechanically cleaned bar screens, grit chambers and sedimentation tanks. Provision will also be made for chlorinating the effluent when this becomes necessary.

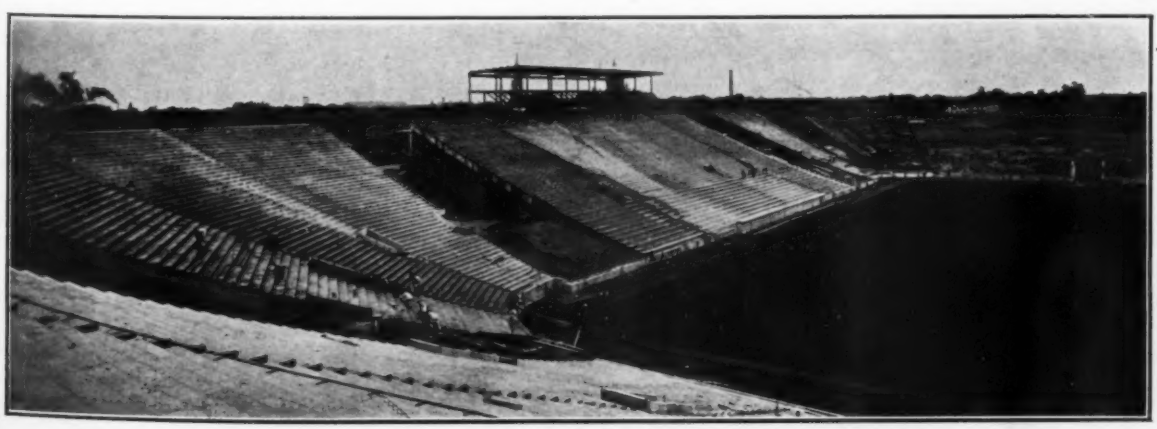
Mr. Potter has also been engaged recently to study the problem of furnishing water to Gouverneur, N. Y. This municipality at present takes its water from the Oswegatchie River. Field work on this project has been completed and the report is now being prepared.

## Progress in Sewage Works Design Visualized

*(Continued from page 85)*

BURDICK & HOWSON. The occasion was a luncheon held June 12 the day following the dedication of the plant, during the Seventh Annual Meeting of the Illinois Association of Sanitary Districts, held jointly at Aurora and DeKalb.

It is interesting to note that a portion of the food served at this meal was cooked in the plant laboratory with gas from the sewage generated in the separate sludge digestion tanks. The gas generated per ten or fifteen families tributary to the plant is enough to supply the ordinary gas consumption of one family. The gas averages from 700 to 850 B.T.U. per cubic foot which is a higher heating value than ordinary gas.



*The Notre Dame Stadium Designed by the Osborn Engineering Co.*

## Recently Completed Surveys for Railway in Bermuda

*Louis P. Blum*

AMONG the recently completed work in the offices of BLUM, WELDIN & Co., 417 Grant St., Pittsburgh, Pa., are surveys for Bermuda Traction, Ltd., of London, England, for a railway which is now under construction for the Islands of Bermuda. This company is at present engaged on reports on atmospheric pollution by industrial dusts, etc., and the effect upon residence districts for several communities.

They have recently acted as expert witnesses in four cases of property damage due to land slips and two cases of property damage due to mining subsidence, as well as in the case of the Pittsburgh Foundry Co. vs. W. E. Moore & Co., an equity case involving certain rights over industrial tracks; various parties vs. the County of Allegheny, Pa., re property damage due to the construction of the Armstrong vehicular tunnels in Pittsburgh; and several cases before boards of viewers, involving damages to property or property appropriated for public use.

Work under construction at the present time under the supervision of Blum, Weldin & Co. includes an addition to the tipple of the Red Bank Coal Co., Clarion County, Pa., and installation of face conveyors as part of the underground mechanization program of this company.

Louis P. Blum is Chairman of the Streams Pollution Committee of the Engineers Council of the Pittsburgh Chamber of Commerce, and has recently delivered a paper on "Property Surveys in Pennsylvania" dealing with the origin and history of land titles, etc.

William Archie Weldin is Chairman of the Pittsburgh Section, American Institute of Mining and Metallurgical Engineers, as well as Chairman of a committee of the Engineers Society of Western Pennsylvania, formed to urge the adoption by local civic bodies throughout Western Pennsylvania, of the nation-wide standards for highway traffic signs, signals and markings, proposed by the American Engineering Council.

*Wm. Archie Weldin*

---

**Thomas J. Morrison**, 414-415 Wilder Building, Rochester, N. Y., has recently completed plans for 4½ miles of storm water sewers and pavement for St. Paul Boulevard, Irondequoit, Monroe County, N. Y., and plans for a $200,000 underground sprinkling system, Whitehaven Memorial Park, Monroe County, N. Y. Construction of both of these projects is being carried on under Mr. Morrison's supervision. William McElwain and John Dorsey recently joined the staff.

## A Paper on the Stability of Electric Utility Securities

AT a meeting of the Contemporary Club of Davenport, Ia., David G. Fisher, of DAVID G. FISHER & Co., Public Utility Engineers, Davenport, Iowa, presented a paper on "The Stability of Electric Utility Securities." Mr. Fisher pointed out that within the past twenty-five years there has been a marked change in the attitude of the average citizen toward the public utilities of the country, a change that has reflected to the advantage of both producer and consumer. The idea of all utilities being soul-less corporations has long since been discarded, and instead these corporations are recognized as necessities of every-day life, the backbone of our commercial prosperity and an indispensable factor in the bringing of conveniences and comfort into the home.

Competitive plants in public utilities are no longer demanded. It is now quite generally recognized that lower rates and better service can not be secured through them. Uncalled-for competition has seldom improved service and often proved disastrous to the outstanding stocks and securities.

These stocks and securities must be protected, said Mr. Fisher, if the utilities are to prosper and thereby function effectively. Then and only then can the public rightly expect the best service. Rates and service go hand in hand. A rate should be guaranteed the utilities sufficient to net a reasonable return on the investment at stake. In return the best possible service should be available to the public.

Mr. Fisher points out that he has endeavored to suggest three things in his paper: first, that very little reduction can be expected in the present generating and distributing costs of electric energy; second, that, due to the fact that the actual operations and policies of the electric companies have been and still are in the hands of able men, and that an increasingly large number of electric consumers are purchasing preferred stock in the electric companies, there is little danger to the industry from the meddling of local politicians; and, third, from lack of better issue or because the situation demands, Congress may investigate the capital structure of electric corporations and rates charged for electric energy.

It is a quite generally accepted principle, says Mr. Fisher, that an electric utility is entitled to rates and earnings that will permit a fair return on the depreciated reproduction values of the plant and property, with allowance for capitalization of interest during construction, engineering costs, organization and legal expenses and going value, so securities authorized and issued on the basis of 70 to 80 per cent of the physical valuations and proved earnings are among the soundest of investments. Argument might be advanced as to what should be considered a fair rate of return since this is practically guaranteed by statute, but so far, Mr. Fisher states that he has never heard that a lower rate than 6 per cent has ever been seriously advocated in any controversy, and 7 to 8 per cent is allowed by most of the State Commissions. Since the prospect of lower production costs is slight, it follows that any reduction in rates will be directly reflected in the net earnings.

# The Editor Comments —

**One Large Foundry Has Anticipated the Rebound of Business**

One of the largest foundries in the United States furnishing castings of all kinds has shown its faith in American business by being ready for the pick-up which, to its joy, it has already found under way.

When one of its salesmen called on a company in the Greater New York area within the last month, he was told by the purchasing agent that there was no order awaiting him, but they were hopeful. A few minutes later a telegram was laid on the purchasing agent's desk. He smiled and looked up at the salesman, saying, "How quick can you ship one thousand castings on pattern G-742?" The salesman reached for the telephone and called his office on long distance, asked for the foundry superintendent and said, "Jim, how quick can you make shipment on one thousand castings on pattern G-742?" The foundry superintendent's voice came back over the line, "We can ship 'em today, if you want us to." The foundry had made the castings in slack time feeling sure that the order was bound to come through very soon. This same episode was repeated three times a week in different offices. The foundry has made an even greater reputation for service, has laid by a greater measure of good will among its customers and has crystallized the prevalent feeling that business has definitely pulled out of the gutter.

Replacement must be made in all kinds of machinery. Where a year to 16 months ago parts would be ordered so that there would be replacements on hand, the reaction during the last 8 months has been to postpone these orders. When they do come, they are going to come with a rush which means delays, higher prices and possible breakdowns which cannot be repaired immediately.

Are you ready?

**The Advertising Index**

One of the largest conservative newspapers published in Massachusetts has an enviable editorial reputation throughout the country. For many decades, its editorials have been quoted from coast to coast. Its business policy has always been conservative and, in spite of this fact, its business has grown so that it has gradually bought up all opposition in both the morning and evening fields until today it controls the entire news output of the city.

One day within the last six weeks two of the advertising salesmen were sitting in the office when the owner of the paper entered. "You boys look pretty well contented, considering the condition of business today," said the owner. "Do you realize that we have had the biggest percentage drop in advertising in 1930, that this paper has ever experienced?" One of the boys immediately replied, "Yes, but didn't we have the biggest percentage increase we ever had in 1929?" Then the owner laughed and said, "I have just been analyzing the advertising income of this paper since the year it started and have discovered a very interesting index. During every financial crisis through which this country has gone, since this paper started, our advertising income has not fallen off until the peak of the crisis was over and business began to pick up. To me the loss in advertising in the last few months shows definitely the improvement of general business conditions in New England."

**How Far Can a Dog Run Into the Woods?**

The Associated Equipment Distributors, as an organization, has contributed a most interesting piece of business literature under this title with more common sense, or may I say "dog sense" in it than has poured forth from big business over the radio and in newspapers in the last few months.

The story starts with a meeting of the Board of Directors of a large commercial organization. Fifteen big business men with long faces sat around a table all predicting that business was going to the "damnition bowwows." Finally a keen-eyed, white-haired man at one end of the table arose a little impatiently, "Gentlemen," he said, "If you will kindly pardon my falling into the vernacular of today, you fellows with your talk of business going to the dogs give me a pain. I want you to answer just one question, 'How far can a dog run into the woods?'" A moment later he answered his question thus, "The answer is just this, gentlemen. When a dog has run halfway into the woods, from then on he is running out! The so-called business depression did not start with the stock market crash in October, it started almost a year before. It was late in June or early in July, 1929, when this dog started into the woods. Most of us didn't know he had gone in, but he had and because he started in earlier than we realized, so also is he coming out sooner than we expect."

The pamphlet continues: "This depression in many basic ways has been a Godsend. It has put Work back on a par basis, it has emphasized the value of planning, it has shown management that it must go to work, too, if business is to go forward.

"Men who know how to work today are too busy to howl. They are making new sales records, selling where they never have sold before. Why? Because the fear-shackled hoard of sellers are so busy 'selling' depression that they have no time to sell goods."

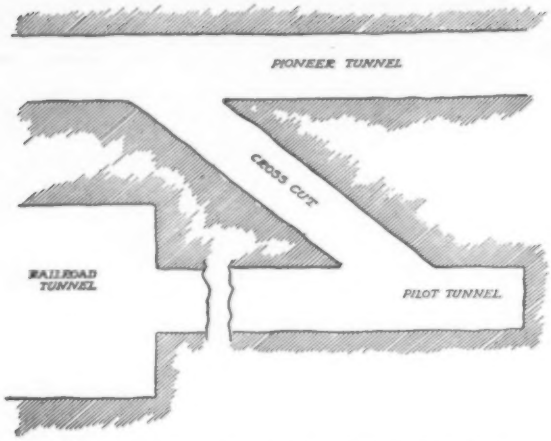
Business isn't going to peak at you from around the corner and say, "Yoo-hoo. Here I am. What will you have?" Instead you have got to dive into those bushes and grab the business at a fair price. Cutting prices won't do the trick. It never has and it never will.

Theodore Reed Kendall

# How to Secure Speed in Rock Tunneling

By

Charles S. Hurter, S. B.




*Plan View of the Rogers Pass System of Tunnel Driving*

THE first principal that must be applied to all parts of high speed tunnel driving operations is the cutting out of delay and lost motion. A regular balanced cycle of operation must be designed and maintained in which delays such as waiting for the gases to be cleared from a heading will be reduced to a minimum and non-productive work such as pulling a deeper round than can be cleaned up in the time allotted for that operation will be eliminated. From start to finish drilling, blasting and loading the broken rock must be carried on with the utmost economy of time, not only as regards each operation in itself, but also as regards the co-ordination of one operation with another.

### Advantages of the Rogers Pass System

Nearly all the record-breaking achievements in tunnel driving have been made with what is known as the Rogers Pass System. In this system two parallel headings, usually from 8 x 8 feet to 9 x 9 feet in size, are driven from 50 to 100 feet apart and one of these is enlarged to form the main tunnel. The heading on the main tunnel line is known as the pilot tunnel and the other as the pioneer tunnel. Every 1,000 or 1,500 feet a diagonal cross cut is driven slanting from the pilot tunnel toward the portal of the pioneer tunnel. All the broken rock from the pilot tunnel is taken out through the pioneer tunnel and work can go on at the face in both of these headings simultaneously. Lost motion is cut out largely by having the drilling crew working in one heading while the other is being cleaned out. This allows the blasting to be done so that the broken rock is left piled up against the face in the most advantageous position for the mechanical loaders. When a full size railroad tunnel is being driven on a single heading plan, the time required to remove the amount of material broken by blasting such a large face limits the rate of advance. In the Rogers Pass System, the pilot heading can be pushed forward independently at a maximum speed and the ring holes for the enlargement of the heading to full size can be drilled and blasted as rapidly as desired. This ring blasting is generally kept well ahead of the revolving dipper shovel that does the mucking and this prevents the broken rock from being thrown long distances and thus does away with cleaning up along the tunnel after the blast. Furthermore, if the enlargement work slows down by the necessity of timbering and lining with concrete due to heavy ground, enlargement operations can be started at the end of each crosscut and carried ahead in both directions, thus speeding up the work.

### Economy of Drilling Time

There are two main factors of economy of drilling time: first, setting up the drills and making footage at the maximum speed and, second, eliminating drilling beyond the depth which it is practical for the round to pull. The use of drill carriages mounting four drills for an 8 x 8-foot heading and carrying the air and water manifolds and the hose, so that only one compressed air and one water connection have to be made, cuts the setting-up time to a maximum of 20 minutes after the carriage with the drills arrives at the face.

On three-shift operations where each shift is a complete cycle, the depth of the round is limited to the depth of cut that can be pulled by a single blast. Where there are only two drill shifts the cut can be blasted twice and hence the depth of round increased. In very easy drilling ground, the cut can be drilled still deeper and blasted three times, but, as a rule, after the second blast, the remaining guns of the cut holes are enlarged to such a size that the proper loading to exclude air spaces in the charge and second good confinement is difficult and the efficiency of the explosive is low. In fact, in high speed tunnel driving, the explosive cost is always high as compared with what it is when time can be relegated to second place and economy can be made the main object.

After the depth of round that will give the maximum advance per shift has been determined upon, great care should be taken in the drilling of holes so that each one will have the proper angle and depth. The holes of the V-cut should be started midway between the center line and the rib line so that they will have the maximum swing and still meet, or nearly meet at the points. The squaring-up holes should be stopped from 12 to 18 inches in front of the bottom of the cut holes

in order to avoid leaving guns in the face, for these not only mean wasted drilling, but also retard and interfere with starting the holes of the next round in the proper position.

### VENTILATION

Good ventilation is a most important factor in fast tunnel driving, for it permits mucking and drilling to follow rapidly upon blasting and increases the efficiency of the men in all three operations. With the Rogers Pass System, ventilation is a simple matter. A brattice is built in the pioneer tunnel just back of the last crosscut and a high duty blower fan is placed there with one pipe leading to the pioneer tunnel and another to the pilot heading. This fan sucks clear air from the pioneer portal and blows it into each heading as desired. The smoke and gases pass out through the pilot tunnel for both working faces.

### SUCTION VS. BLOWING ON SINGLE HEADINGS

Where only one heading is driven, the ventilation problem becomes more difficult, and there is considerable difference of opinion as to the relative merits of suction and blowing. A fan will handle more air on blowing than it will on suction because of the partial vacuum in the pipe through which air is being drawn, but with suction there is clear air from the portal to the end of the pipe.

Whether blowing or suction is used, the end of the main ventilating pipe should be kept at a sufficient distance from the face so that it will not be damaged by the blast nor the projected material. It should also be kept as high as possible from the floor and as far to one side as possible. This distance back from the face will depend upon the violence of the cut shots as these are the heaviest because of their tightness and throw broken rock farthest, but it is rarely less than 100 feet and in exceptional cases may be 300 feet.

Consequently, with either system of ventilation, in order to clear the smoke and gases of blasting out of the heading, some method should be provided to remove the air between the end of the ventilating pipe and the working face. The best practice demands that throughout the cycle of operation, a stream of as fresh air as possible should be blown across the working face. This moving current of fresh air is needed not only to dissipate the fumes or gases that may be released from the muck pile while mucking is in progress, but also to sweep away both the oil-laden mist from the exhaust of a battery of rock drills at work and the minute particles of rock dust which fill the air.

A common method of supplying air at the rock face is from the compressed air line. This can be laid on the bottom close to the rib up within a very short distance of the face. If the suction system is to be used, the compressed air jet is placed on the opposite side of the tunnel from the ventilating pipe, the compressed air will naturally circulate across the face and back along the other rib to the south of the ventilating pipe from whence it will be drawn out of the tunnel. Compressed air at the face is undoubtedly much better than no moving air, but it is not fresh air from the outside and the small diameter and the force of the jet tend to cause it to cut through the stagnant air in the heading rather than to move and dissipate it.

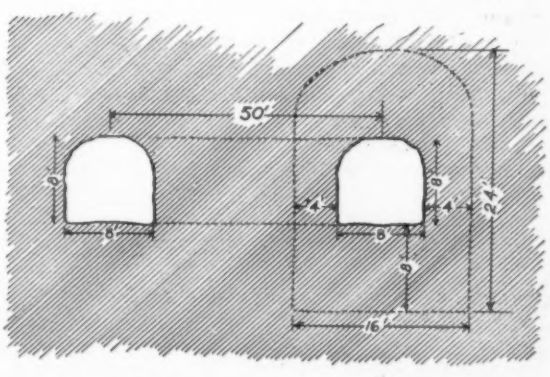
Therefore, if the blowing system of ventilation is used, the most effective procedure is to have a length of flexible ventilating pipe such as Ventube which can be run from the end of the metal pipe directly to the face after each round has been blasted and can be taken down, rolled up and put in a protected place at firing times. This will make it possible to clear out the heading quickly and to deliver an adequate volume of fresh air to the working face while the men are loading the broken material and drilling and blasting the next round.

If the suction system of ventilation is used, the best scheme for clearing the heading and providing fresh air for the men at the face is to have an auxiliary fan to blow air up into the face throughout flexible pipe. The fan is placed in the clear air back of the intake end of the main ventilating pipe and the Ventube is hung directly to the face as soon as possible after the blast. At blasting time the Ventube is rolled up and put in a safe place where it will not be damaged by flying pieces of rock. In some instances, depending largely upon the power of the fan and the distance to the portal, it is an additional aid to have a brattice, with holes in it for the two pipes to pass through, placed across the tunnel back of the intake end of the metal pipe.

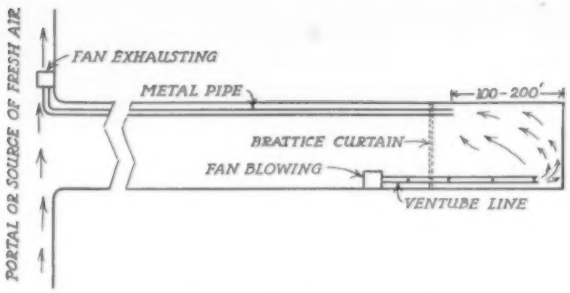
In a number of tunnels where the operator desired to ventilate by suction, an economical scheme has been worked out by placing the fan up in the tunnel with spiral riveted or welded pipe extending from it to a safe point back of the face and Ventube from the fan to the portal. With this arrangement the fumes are sucked from the face to the fan and thence are blown out through the Ventube to the portal. Of course, it is necessary to move up the fan and pipe from time to time and lengthen the line of Ventube.

The reversible air current for ventilation has met with great favor with a large number of tunnel men. In this system, the gases after blasting are drawn out by suction and then the same ventilating pipe is used to blow fresh air into the face. Here, again, a line of flexible ventilating tube should be run from the end of the metal pipe which will probably be at least 100 feet from the face, directly to the face before beginning to blow.

Whatever the system of ventilation adopted, it is a great mistake to try to economize on the size or capacity of ventilating apparatus. The fan should have capacity and power in proportion to the length of the tunnel. On long ventilating pipes the Anaconda Cop-




*Cross Section of the Rogers Pass System of Tunnel Driving*




*System of Ventilating by Means of Suction in the Main Line and an Auxiliary Line for Blowing Fresh Air into the Face*

per Mining Co. of Butte, Montana, places a booster fan approximately every 2,500 feet. If metal pipe is used, it should be of the welded or spiral riveted type, with copper gaskets, or its equivalent. Common galvanized sheet pipe is too light to stand up under the heavy jars of tunnel blasts. In a very short time it develops leaks which, as the pipe is extended, reduce greatly the efficiency of the ventilation.

### Choice of Explosives

In order to aid tunnel drivers the du Pont Co. has made an intensive study in recent years of ways and means of reducing fumes after blasting. Its technical field men have visited large tunnel projects at frequent intervals and in many cases research chemists from its laboratories have been sent to observe operations and analyze fumes after blasting. These researches have resulted in many improvements in the formulae of gelatin or dynamite and in the use of a special paper for wrapping the gelatin. Together, these measures have automatically decreased the volume of objectionable fumes from the blasting so that less time is lost in blasting and mucking than in former years and the men can work more efficiently, particularly while the rock is being loaded out of the heading. With the straight gelatins, there is some unavoidable increase in the volume of noxious fumes from the strengths above 60 per cent, whereas with the ammonia gelatin, the noxious fumes are kept to a minimum up to and including the 80 per cent strength. Therefore, when 75 or 80 per cent gelatin is necessary in close places, ammonia gelatin should be used rather than straight gelatin.

Moreover, the ammonia gelatins of all grades are less inflammable than straight gelatins. If the explosive in the charge is ignited by the side spit from the vent of the delay electric blasting cap, as sometimes happens with straight gelatin, the burning dynamite will considerably increase the poisonous fumes after the blast. The use of 75 to 80 per cent ammonia gelatin in high speed tunneling is a protection against this possible source of delay.

### Co-ordinating the Drilling, Blasting and Removal of the Broken Rock

In the main the removal of the rock after blasting is the key to rapid tunnel driving. It is no use trying to pull a very deep round if the rock cannot be removed and the next round drilled by the time set for blasting in the cycle of operations. In the 8 x 8-foot or 9 x 9-foot headings used for the pilot and pioneer tunnels of the Rogers Pass System, this question is very simple as one heading is being drilled while the other is being cleaned up.

Where a single tunnel is driven, various schemes may be resorted to. In easily blasted ground the problem is sometimes handled by having two drill shifts and three mucking shifts. Sometimes when the heading is carried full face, a cross bar can be set up near the top as soon as the men return to the face after blasting and the upper part of the face can be drilled from the top of the rock pile, while the rock is being removed behind and below.

Where all the rock is shoveled by hand, it speeds up the work to load the lifter shots as heavily as possible and shoot them the last of the round. These holes then perform the twofold service of breaking their burden to maintain grade and of throwing, as much as possible of the rock pile back from the face so that the shovelers can get the face cleaned out in the minimum time ready for the drilling crew to bring up their equipment and start work.

Mechanical loaders work best when the broken rock is left piled up against the face. To secure this result in a full face 8 x 8-foot heading, the lifters should be fired simultaneously with the side and top holes. In a larger heading which is being carried full face, the lifters should be blasted as early as possible in the sequence of shots and the top holes last. If the tunnel is being driven by the heading and bench method, the bench can be quickly cleaned up by hand shoveling and the heading drilled while the mechanical loader removes the broken material from in front of the men. In this system the cut should be carried clear to the floor of the heading. While this makes the cut a little tighter and requires a little more explosive, more rock is thrown clear of the bench and this reduces the amount of hand labor. To prevent the rock broken by the cut blast from being thrown a long distance down the tunnel and spread in a thin layer which will be slow and expensive to clean up, it is a good scheme to have the bench drilled with lifters and blast the top line of lifters with instantaneous electric blasting caps at the same time as the cut. The rock coming from below then meets that thrown out by the cut and keeps this from being thrown any great distance back from the face.

## Plans for Annual Meeting of National Paving Brick Manufacturers Association

THE twenty-fifth annual meeting of the National Paving Brick Manufacturers Association will be held at the William Penn Hotel, Pittsburgh, Penna., February 4, 5 and 6, 1931. The program for the last two days will include papers and discussions of the latest practices in the design and construction of streets and highways, particularly the vitrified brick type.

The program now under preparation will be presented by prominent engineers and paving authorities. It will include descriptions of recently constructed brick super-highways, and discussions of such subjects as the resurfacing of old pavements with vitrified brick, the salvaging of old brick in reconstruction projects, fillers for vitrified brick pavements, efficient management of brick paving contracts and highway research applied to brick pavements for city streets and interurban highways.

# Missouri Contractor Operates Large Sand *and* Gravel Plant

## *Especial Care Taken in Layout of Plant and Portability of Equipment*

SOME of the concrete paving jobs carried out under the 1930 road construction program at the Missouri State Highway Department required such quantities of sand and gravel aggregates that often good size washing and screening plants were erected and kept running at full blast for several months. Whenever a highway was being built within trucking distance of a commercial sand and gravel plant, such a plant was in a favorable position to furnish the material for the job. However, much of the highway work was beyond the reach of the established plants and, to avoid excessive haulage costs, the highway department in such cases usually let the contract for the material in the same way as contracts are awarded for other parts of the job and the contractor or sand and gravel producer who takes the material contract erects a special plant to take care of the job.

One of the contractors successfully engaging in this work is M. E. Gillioz of Monett, Mo., one of the largest contractors in the state whose activities include street and road work, building construction and the erection of bridges. About a year ago, these varied activities had not included the production of sand and gravel, but once in the field Mr. Gillioz and his staff of assistants have developed a technique in installing and operating plants required for providing aggregate for highway contracts. Early in the summer of 1930, Mr. Gillioz erected a small plant which is equipped with a ¾-yard Sauerman power drag scraper for excavating material. Since the time the machine was installed it has been followed by four other Sauerman machines to dig material for other plants which he has installed. A ½-yard portable scraper outfit used in connection with one of his bridge jobs and three other machines, a 1-yard portable scraper, a 1½-yard power drag scraper and a 1-yard slackline cableway excavator, fur-

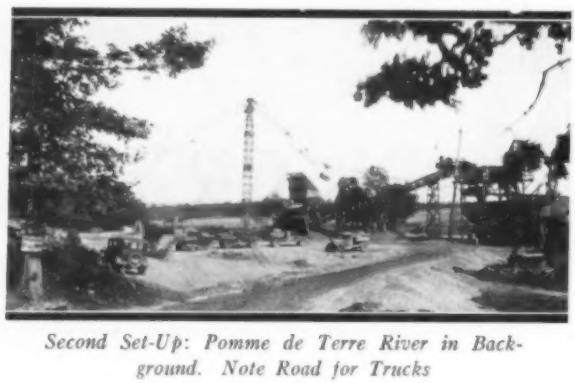
*A Panoramic View of the First Installation of the Gillioz Cableway Plant*

nished concrete aggregate for the paving of U. S. Route 65 north of Springfield.

### TWO SET-UPS FOR PLANT ON ONE ROAD JOB

The Gillioz plant on U. S. Route 65 produces enough aggregate to supply two pavers laying a 20-foot slab at the rate of from 2,400 to 2,800 feet daily and a third paver which started work late in August.

The illustrations show the 1-yard slackline cableway and the washing and screening plant which it serves. This plant is now working at a second set-up digging material from a deposit of sand and gravel adjacent to the bed of the Pomme de Terre River near Fair Grove, Mo., a few miles out of Springfield. The first and second set-ups were practically the same except that the second used the full 80-foot height of the Sauerman steel mast while the first used only three of the four mast sections. Also, in the second installation the belt conveyor leading from the field hopper to the screens was lengthened by one section to give a flatter incline.



*Second Set-Up: Pomme de Terre River in Background. Note Road for Trucks*

The slackline cableway machine excavates the sand and gravel from the river bed deposit and lifts it to a large grizzly above a field hopper where the largest boulders are taken and chuted to a waste pile. The material entering the hopper passes through a rotary scalping screen. The oversize from the screen passes through a crusher and both the crushed material and the fines from the scalping screen were fed to an inclined belt conveyor leading to the screening plant. At the top of the conveyor the material was fed to a jacketed rotary washing and sizing screen and the various screened products were sorted to their respective bins from which they were loaded into trucks for transportation to stock piles along the route of the paving construction. A well built road for the trucks was built from the main road into the plant.

An unusual feature of this operation is that the material as it is found in the natural deposit contains less sand than the proportion required by the State specifications for concrete mixing. Therefore, to make up for this deficiency of sand, some of the gravel is run through high speed rolls and broken down to the size of sand.

The washing and screening plant is a staunchly built structure of steel so designed that it can be taken apart easily when it is desired to move to another location. The slackline cableway is provided with a 2-speed gasoline power hoist, which is particularly suitable for a plant of this kind because of the ease of furnishing fuel to it wherever it may be moved.

The main offices of M. E. Gillioz are located at Monett, but offices are also maintained at Springfield for the supervision of the jobs near that city and all of the gravel operations in the vicinity are in charge of M. F. Curran, General Superintendent.

# How 165 Contractors Handle Their Trucking

IN a motor truck analysis recently completed by the General Motors Truck Co., Pontiac, Mich., a special letter and questionnaires were sent to truck owners all over the United States. Replies were received from 7,978 separate business firms using trucks, 5,584 of which filled out the questionnaires with sufficient completeness to be tabulated, giving statistics on 46,017 trucks owned and operated by them.

Replies from 165 general contracting firms indicated that they used a total of 993 trucks, 475 of which were light duty trucks of ½ to 1½ tons capacities, representing 48 per cent of the total; 317 or 32 per cent of the total, were medium duty trucks with capacities from 1½ to 3 tons; and the remaining 201, or 20 per cent, were trucks from 3½ tons up.

In reply to a question regarding the use of special bodies made and adapted to special requirements by body makers, 79 firms or 49 per cent reported the use of special bodies, 69 firms or 43 per cent said they use standard bodies and 12 firms or 8 per cent use both types.

The next question was "How do you pay your drivers," to which 152 firms or 95 per cent, replied that the drivers received a straight salary, 7 firms or 4 per cent pay a salary and bonus and two, or one per cent, pay a straight commission.

With regard to operating experience the replies indicated that light duty trucks averaged 13.1 miles per gallon of gas and 101.6 miles per quart of oil, carrying an average payload of 2,538 pounds approximately 14.3 miles with an average of 21.2 stops per day. The operating cost for light trucks, including maintenance and depreciation per mile, averaged 10.9 cents.

Medium duty trucks traveled approximately 9.2 miles per gallon of gas and 101.8 miles per quart of oil. The average payload was reported as 6,528 pounds over a haul of 16.7 miles with 21.1 stops at a total truck operating cost, including maintenance and depreciation of 18.4 cents per mile.

Heavy duty trucks averaged 6.8 miles per gallon of gas and 60.5 miles per quart of oil, carrying an average payload of 10,583 pounds. The average haul was 17.6 miles and the average number of stops 29.7 per day. The operating cost averaged 37 cents per mile, including maintenance and depreciation.

Twenty-four owners did not reply to a question as to whether all hauling and delivery was done with the company's own trucks. Of the remainder 70 owners said yes and the remainder no. Of those who hire some trucking done, 34, or 48 per cent, hire trucks for cartage to and from a railroad; 60, or 86 per cent, for heavy delivery; 29, or 41 per cent for long distance hauling; and 20, or 28 per cent, for light delivery.

## A Photographic Record of the Construction of the Ambassador Bridge

MCCLINTIC-MARSHALL CO., Pittsburgh, Pa., general contractors, fabricators and builders of the Ambassador Bridge, spanning the Detroit River and connecting the city of Detroit with the border cities grouped about Windsor, Ont., has published a most interesting pictorial record of the great structure which links Canada and the United States. The photographs begin with the United States anchorage caisson shown on October 26, 1927, and carry the structure through to completion showing in considerable detail the various operations.

# How the Other Fellow Did It

*Construction Briefs*

## Pouring Concrete Bridge Arch Rings in Winter

**44.** On an 1,100-foot concrete arch bridge in Pennsylvania, two of the five main river arch spans, each 162 feet in length with open spandrel walls, had to be poured in winter. Forms for the arches were supported on steel centers and the forms and covering completed for the entire arch ring before the pouring was started. The form wall projected about 2 feet on each side, so as to provide a walkway on each side of the arch ring. Side and overhead supports were placed so that the tarpaulins would clear the tops of the forms by at least 5 feet, to permit space for the workmen while placing the concrete. After the forms had been placed, the tarpaulin was stretched around the bottom and overlapped and sewed at the top. Flap openings were left at each end and at the crown of the arch for the convenience of the workmen and a flap opening was also provided for the entrance of the chute and concrete at the highest point in each section. Each arch ring was poured in 7 sections, the two haunches to about the quarter points first, followed by the crown, then the two sections between the quarters and the crown, and last the key section at each end at the piers.

The aggregates in the stock piles were kept securely protected from the weather and perforated steam lines through the stock piles were supplied with steam several days in advance of the work. The stock piles were not permitted to cool until the pouring was completed. When stone and sand were not being taken from the stock piles, they were kept covered with tarpaulins. The temperature of the material in the stock piles was kept at about 60 degrees Fahrenheit. The water was heated by a boiler and the temperature kept between 80 and 110 degrees. A blow torch flame was provided for use in the drum of the mixer and when mixing, the flame was used continuously. The concrete was mixed for 1½ minutes and had a temperature of 70 degrees. By continuing the mix for two minutes the temperature was raised 5 to 10 degrees. A 2 per cent solution of calcium chloride was used in the mixture.

The concrete when taken from the river was conveyed by a lift and cableway for a distance of 700 to 800 feet over the portions already completed to the rings being poured and protected as described above. Here the bucket was dumped at the proper elevation and chuted through the flap opening into the forms. The interval which elapsed from the time the concrete was taken from the mixer until it was placed in the forms was an average of 5 to 6 minutes. In this time the concrete lost about one degree of temperature when the air temperature was 32 degrees. The tarpaulin permitted only a small amount of daylight to filter through, so that it was necessary to provide gasoline lanterns for the use of the workmen.

The forms were heated with salamanders and steam lines for 12 to 24 hours before the concrete was placed so that the form would be thoroughly warmed and the temperature at all parts would be at least 50 degrees Fahrenheit. The salamanders were used while the concrete was being placed, but as soon as the placing of the concrete was completed and the flaps sealed, live steam was turned into the forms and was continued for a period of 5 days, the temperature inside the forms being maintained at 50 degrees or more during that period.

The live steam pipes and salamanders were carried on the form work under the arch rings and the heat had free circulation inside the tarpaulins covers. The salamanders were fired with coke and these fires were permitted to go out soon after the concrete had been placed and the live steam turned on, as the steam alone furnished sufficient heat. The live steam was let into the forms through ¼-inch jets with a jet provided for each 2,000 cubic feet of air space. When pouring the sections of arch rings near the lower end, canvas curtains were hung near the upper end of the section being poured in order to bulkhead the heat and prevent it rushing to the crown of the arch. 18.4.252

## Twin Batchers Speed Loading of Batch Boxes

**45.** On a huge playground project where 72 acres of concrete parking fields were being poured, in 10-foot strips, the contractor used a novel method to save time in loading the batch boxes on the trains of industrial cars. The batchers were arranged in pairs of two stone batches and two sand batches at just the correct intervals to permit loading the sand into two batch boxes and at the same time stone into two boxes on the car ahead. The crew for the batchers and train consisted of two men on the batchers, one locomotive engineer and one train man. After very little practice the engineer was able to spot the cars very easily and the batchers were so placed that the slight slack in the trains made no difference in delivering the batch directly to the boxes without spillage. 19.2.59

## Using a Truck Crane to Demolish a Building

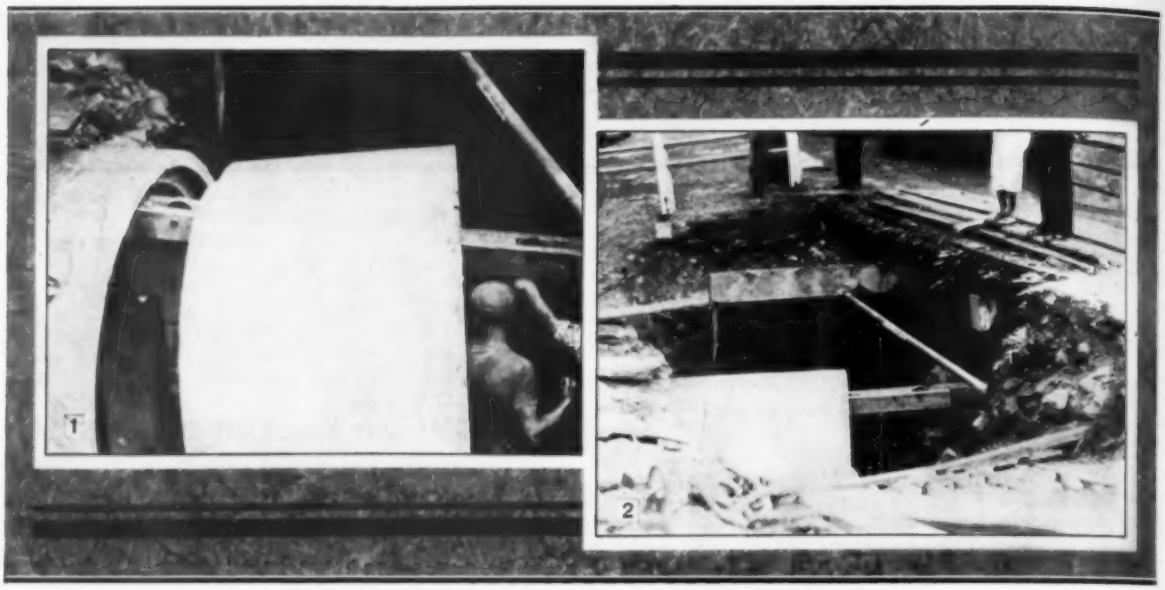
**46.** In demolishing a 6-story wall bearing structure with stone exterior walls, and approximately 1,700 tons of face stone, a New York State contractor employed a truck crane, which was run up the ramp onto a timber platform 20 feet above the sidewalk and on two sides of the building which was on a corner. The crane built the platform as it progressed until it enclosed the outer perimeter of the building. The total cost of erecting the sidewalk bridge was about $1,200.

From its position on the trestle, the crane, equipped with a 65-foot boom handled all stones directly from their position in the walls into trucks at the sidewalks. It traveled back and forth on the trestle as necessary to most efficiently handle the work, resembling a locomotive crane in its flexibility of operation. 19.1.85

## An Expansion Joint Spacer

**47.** Where the specifications call for a 4-inch expansion joint every 1,000 feet in a pavement slab, the contractor is required to leave a complete 4-inch break in the pavement which is filled with asphalt by the maintenance crew of the State Highway Department. An Illinois contractor developed a novel collapsible form for the expansion joint which made it easy to remove the joint and insured the joint being accurate and uniform.

Each form consisted of three pieces of 2 steel plates, ¼ x 9 inches by 6 feet with spacers welded to them so that bolts could be slipped through slots in the upper spacers and the forms held rigidly to the proper dimensions. At the top a ¼-inch steel plate fitted so that it was flush with the top of the concrete slab thus permitting the finisher to work over the joint without interference. To remove the spacer, it was only necessary to loosen the bolts and collapse the forms. Three of these forms were used across an 18-foot slab. 19.2.74



*METHOD OF HANDLING PIPE SHOWN PICTORIALLY*

*1. Roller beam inserted through section of pipe to be set and beam held tight in completed pipe by a jack. 2. New section of pipe rolled into place giving a tight joint*

# Handling 72-Inch Concrete Pipe Without An A-Frame

ON a recent job in Caldwell, N. J., Joseph Ell of Newark, N. J., contractor, faced the problem of laying about 300 feet of 72-inch concrete pipe in the bed of the brook which cut through land purchased by the civic center of the community. One side of the brook was above the level of the top of the pipe and the other side was lower, but even on the high side it was possible to skid the pipe down the bank, using a roller in the pipe and holding it with a block and tackle made fast to trees on the bank.

After the pipe was down on the bottom of the brook which had previously been cleaned out to the proper grade, a built-up beam with inserted rollers, as shown in the illustration, was placed inside the pipe and the end inside the previously laid pipe was jacked up against the top of the pipe. The other end was then jacked up high enough to lift the new section clear of the ground and the pipe was then shoved home readily by two men using crowbars. Releasing the jack permitted the pipe to rest on the ground and everything was ready for laying the next pipe. The pipe was laid very accurately to line and grade in this manner and tight joints were obtained. The contractor used only four men and with this gang completed the excavation of the trench and laying the 72-inch concrete pipe in 11 working days.

The laying of this 300 feet of Newark Concrete Pipe Co.'s 72-inch pipe was done under the direction of A. H. Summerville, Town Engineer of Caldwell, N. J.

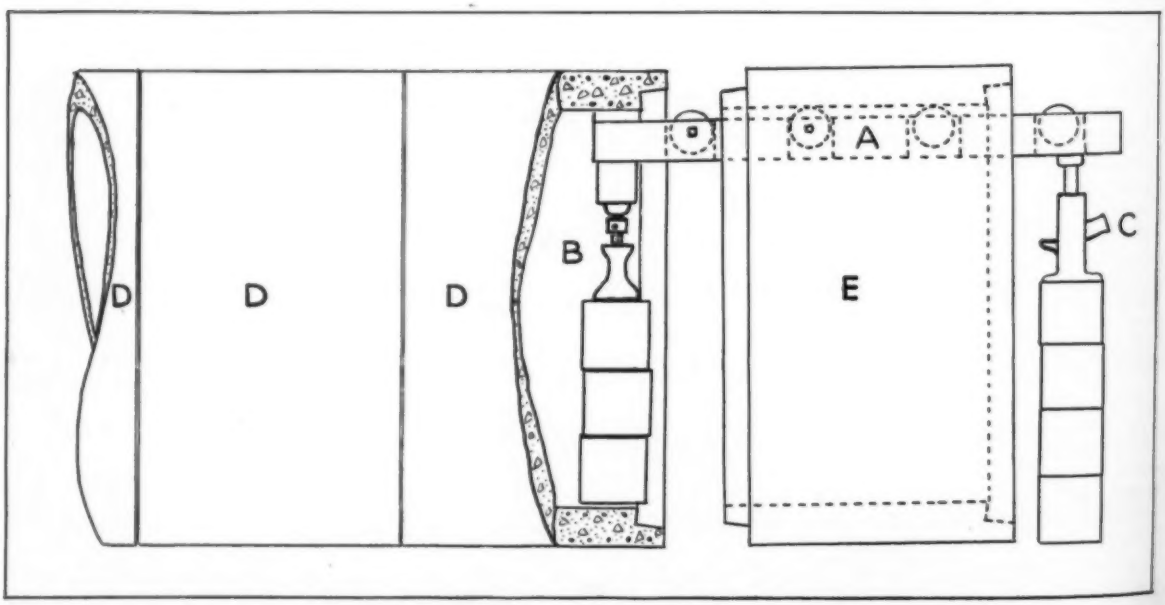



*Diagram Showing Method of Setting Roller for Placing New Section of Concrete Pipe*

# Legal Points for Contractors

***These brief abstracts of court decisions in the contracting field may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt consult your own attorney***

**Edited by A. L. H. Street, Attorney-at-Law**

## Withdrawing Bid on Account of Mistake

"I want to withdraw my bid on that sewer job, because I forgot to include the cost of manholes," said a bidder to the governing board of a Wisconsin village. "I, also, want my $2,000 check back—the check I deposited to secure entry into a contract, should my bid be accepted."

Although this demand was made before the bids were opened, the board refused to give up the check and awarded the contract to the unwilling bidder. On his refusal to enter into a contract, the board declared the $2,000 forfeited.

But in an opinion filed January 7, 1930, the Wisconsin Supreme Court decided that, since the bid was withdrawn before it was acted upon, the bidder was not bound to accept an award of the contract and was entitled to return of the deposit. (Gavahan v. Village of Shorewood, 228 N. W. 497). The court followed the rule that has been often laid down by other courts—that an offer may be withdrawn any time before it has been acted upon. The court made this comment:

"We are of the opinion that, when a bidder who has made a mistake in his computations, or mistakenly omitted items from consideration in making his estimates, in good faith, asks to withdraw his bid for correction before the bids are opened, he is entitled to withdraw it; and that if, in such case, the municipality refuses to allow him to withdraw it, he is entitled to recover his deposit. It may be that such a rule will allow dishonest bidders to claim mistakes, when there is none in fact. And it will require readvertisement where there is only one bid, if the bidder does not file a corrected bid. But the city is in no worse position than it would be, had no bid been filed at all, and here there were other bids, so readvertisement would not have been necessary."

## When Customs Do Not Apply

It is luck, rather than good judgment, that saves many a contractor or subcontractor from heavy money loss, when he fails to stick to the terms of an agreement or specifications concerning the quality of work or materials to be furnished.

An object lesson for every contractor or sub who is disposed to slight contract requirements will be found in the case of Biedenharn v. Water, 126 So. 508, decided by the Louisiana Supreme Court February 3, 1930.

After a $50,000 building had been completed, the owner and his supervising architect rejected the artificial stone porch constituting a front entrance, on the ground of defective material and workmanship. Resulting litigation ended in the owner being allowed more than $4,000 to cover the cost of reconstructing the porch.

The court decided that neither the general contractor nor a third party furnishing the stone could defend failure to furnish stone of the quality and dimensions called for by the contract by showing that other contractors customarily used the same kind of stone that was installed.

It was argued that the owner was liable for at least the reasonable value of the stone furnished, but the court said:

"Under the circumstances, it cannot be successfully contended that a temporary enforced use of the stone, to the great annoyance of the plaintiff, renders him liable for the reasonable value of the stone, or for any sum whatever."

## Queer Notions of Law

It is not specially surprising to be told that two hundred years or so ago it was commonly believed in England, and probably in the colonies, that if a bride-to-be should walk across a street clad only in chemise that would relieve her future husband of any legal liability for her debts.

But it is surprising to know that in the year 1930 there is a very common misconception in our own country that a deed, contract, will, or other document is not legally binding if signed in pencil; that signatures not in ink are invalid. There is no legal requirements for the use of ink; the law does not even require the use of paper.

A contractor could make and sign a perfectly legal check, deed, contract or other instrument on a piece of board, using a nail as an inkless pen. Or he could use a block of green cement and a nail or other instrument to inscribe the necessary wording and signature. In fact, several thousand years ago the Babylonians actually used stone and chisels instead of pen and paper for the preparation of legal documents. Imagine dictating a contract to a stone-cutter instead of a stenographer!

However, the fact that a pencil may be used in drawing checks, etc., without rendering the documents invalid should not encourage such use. Particularly dangerous is the practice of drawing checks in pencil writing, because of the facility with which the amount of a check may be raised by erasure and rewriting the amount. Some courts have held that this is so careless a practice that the paying bank cannot be held liable to the maker of the check on innocently paying it for a raised amount.

## Relation of Stockholders to Corporation

"While you were hauling materials for that highway job over the streets of our city your trucks damaged the streets and we demand the cost of repairs," declared a Kentucky city attorney to a firm of highway contractors.

"Beg your pardon, but we did not haul any materials over your streets," replied the highway contractors. "We let the hauling to an independent company, and your claim should be filed against it."

"But you and the company are practically the same, because you own 48 per cent of the stock of the haulage company," rejoined the city attorney. "You can't pull any of that Dr. Jekyll and Mr. Hyde stuff on us."

The parties could not agree on that point and a lawsuit followed, winding up in the Kentucky Court of Appeals. (Hatfield Construction Co. vs. City of Paintsville, 20 S. W. 2d, 713, decided October 4, 1929.) The contractors won out on the ground that the fact that they owned stock in the haulage company made that company none the less an independent concern. The Court of Appeals said:

"It is plain that whatever damage was done was caused by the truck company's agents and not those of the construction company. The truck company was paid a unit price by the construction company for hauling the material, and the construction company did not undertake to state how or in what manner or by what method the hauling should be done. The truck company was an independent contractor."

## Purchasing Second-Hand Equipment

The contractor who buys equipment that has been used buys "as is," excepting as he induces the seller to make a special warranty. In the case of Brierton v. Anderson, 20 S. W. 2d. 313, decided by the Arkansas Supreme Court October 7, 1929, that court denied the buyer of a second-hand dredge boat money relief against the seller on account of the boat failing to come up to the buyer's expectations. The opinion applied a well-settled rule of law "that the sale of a second-hand article carries no implied warranty as to the quality, condition, or fitness for the purpose intended of such article, and this is especially true where the property is subject to inspection at the time of sale."

## Highway Contractor's Bond Held Broad in Its Coverage

If Shakespeare were writing "The Merchant of Venice" now and in the light of modern conditions, he probably would have had Portia argue the effect of Shylock's bond from a different angle. Had Portia followed present-day methods she would have argued that the bond calling for a pound of flesh next to Antonio's heart did not mean a pound of flesh next to the heart, but something entirely different, instead of admitting, as she did, that the bond meant what it said and then turning that meaning against Shylock.

In the case of Western Material Co. v. Enke, 228 N. W. 385, a highway contractor gave a bond "to pay all just claims for materials, supplies, tools, appliances and labor, and all other just claims incurred in carrying out the provisions of the contract."

Contrary to contentions of counsel for the surety company, the South Dakota Supreme Court decided that this bond covered rental charges for use of equipment hired by the contractor, and cost of repairs necessary to keep his plant and equipment in operating condition. The court said, in part:

"Where a machine is employed in the performance of different contracts under varying conditions, it is impossible to compute exactly the amount of wear and tear in fact imposed on a machine in the performance of any particular piece of work. When the repairs becomes necessary to keep the machine in operation for the performance of the work, it must be made. . . . The matter is not, practically speaking, susceptible of mathematically precise allocation."

But it was decided that the bond did not cover the purchase price of general plant and equipment items.

## Slandering Competitors

*The author of the time-worn saying that "talk is cheap" could not have been thinking about the law of libel and slander when he spoke. Talk is usually very expensive when one is checked up in court for having falsely accused another. "Never say or write anything injurious to the reputation of another without first conferring with your lawyer" is a better adage to have in mind than "talk is cheap," if you are inclined to "pan" a contractor who is your brother or rival (whichever way you look upon him) in business.*

*To constitute actionable defamation, it is not necessary to falsely accuse one of having been committed of a crime or of having committed some act that would naturally cause him to be shunned in polite society. Any false statement that tends to injure the accused person in his social or business standing is actionable. To untruthfully accuse a contractor of lacking skill or honesty in his business dealings is an invitation to a heavy damage judgment. So, too, is a false accusation of insanity or intoxication. Dangerous, also, is it to say, without warrant in fact, that a certain person is "broke" or does not pay his bills promptly.*

*One who speaks or writes defamatory words concerning another is a guarantor of their truthfulness. To say that the libel or slander was communicated to him by a third person and was believed by him to be true when he repeated it is no defense to an action for damages.*

## Forged Check Phases

Banks are not always inclined to admit their liability for paying out money on forged checks or forged endorsements. Hence, it behooves every contractor, or his cashier or treasurer, to be careful to give his bank no room for claiming that the contractor was at fault. Experience shows that it is often cheaper to use more care than the law requires than less.

Careful writing of checks is the first safeguard against controversies on account of raised or forged checks. It is just as easy to write a check that does not invite tampering by a forger as one that does. To illustrate, what can be more tempting to a dishonest man than to get his hands on a check where it has been written thus: "$ 10.00," instead of "$10.00," and especially when there is enough space left on the next line, in front of the words "Ten and no/100 Dollars," to permit any number of hundreds to be written in by a forger? Use of check protectors is desirable, although not legally necessary to protect the check maker. To draw a check in pencil is to court trouble.

Another important precaution is to secure all canceled checks from your bank on the first banking day of the month and carefully verify the correctness of each check, as to amount and payee. If any irregularity be found the bank should be instantly notified. These precautions are often vital to the right to hold the paying bank liable for the loss resulting from its having paid a forged or altered check.

## Withdrawing Partners

That one may be partner without being a partner is shown in the important decision handed down recently by the Supreme Court of Mississippi in the case of Schwartz Bros. Co. v. Beachem, 127 So. 689.

Mrs. Beachem withdrew from a commercial partnership, but no notice was given to parties who had extended credit to the old firm in the course of continued dealings. The old firm name, which included her name, was continued. Under these circumstances, the court decided that she was liable to creditors who extended credit to the business from which she had retired, on a reasonable supposition that she was still a member of the firm.

The obvious moral of this decision for all withdrawing partners is to make sure that proper notice of dissolution is given to all parties dealing with the partnership as creditors at the time of dissolution.

## Wearing Wife's Skirts

Where a contractor sells out his business and agrees that he will not engage directly or indirectly, or concern himself, in the same line in competition with the buyer, the courts will enjoin the seller from operating a competing business in the name of his wife. Authority for this statement appears in the decision made by the New Jersey Court of Chancery in a recent case (148 Atl. 174). Replying to a statement that to prevent the seller from doing business either in his own name or his wife's would prevent him from bringing home the bacon, the court said:

"The answer to that is if he is so prevented, he is prevented by the contract he entered into."

# Construction Industry News

**Pennsylvania-Dixie Cement Corp.**, New York, has announced the appointment of B. W. Druckenmiller as Assistant General Sales Manager. Mr. Druckenmiller, who was formerly associated with the Crescent Portland Cement Co., Wampum, Penna., has been Sales Manager for the past two years and is succeeded by F. J. Selinger, Jr. Mr. Selinger was formerly associated with the Atlas Portland Cement Co. The offices of this company are located at 521 Fifth Aveune.

**Climax Engineering Co.**, Clinton, Iowa, has recently appointed the following distributors for northwestern United States and western Canada: Steeples Engineering Co., 164 Hanford St., Seattle, Wash.; Construction Equipment Co., 1118-24 Hyde Ave., Spokane, Wash.; British Columbia Equipment Co., 551 Howe St., Vancouver, B. C.; Brown-Frazer Equipment Co., 115 Homer St., Vancouver, B. C.; Hall Perry Machine Co., 812 Iron St., Butte, Mont., and Commercial Iron Works, Union Ave. & Stevens St., Portland, Ore.

**Wallace & Tiernan Co., Inc.**, Newark, N. J., has recently made a number of changes in personnel. F. G. Merkel, for the past eight years manager of the Chicago office, has been appointed Sales Manager of the Wallace & Tiernan Products, Inc., and will move to the company's head office at Belleville, N. J. C. O. Bruden, formerly Assistant Manager, has succeeded Mr. Merkel in the Chicago office.

W. A. Hockett, Manager of the Indianapolis District office, has been transferred to the company's home office in Newark and will have charge of the company's foreign activities. E. F. Kinney has been appointed District Manager to succeed Mr. Hockett. Charles H. Eastwood, formerly in charge of Wallace & Tiernan Co.'s foreign sales, is now in charge of advertising and publicity for both Wallace & Tiernan Co. and Wallace & Tiernan Products, Inc.

**Speeder Machinery Corp.**, Cedar Rapids, Iowa, has recently made the following additions to its sales organization throughout the United States and Canada: R. F. Sanchez as Export Manager with offices at 50 Church St., New York; B. C. Larrabee as District Sales Engineer with headquarters at Seattle, Wash.; Harry E. Zabel as District Sales Engineer with headquarters at St. Paul, Minn.; W. A. Avery as District Sales Engineer located at Chicago, Ill.; R. C. Higley as District Sales Engineer with headquarters at Dallas, Texas. A. D. Lane, formerly District Sales Engineer with headquarters at St. Paul, has been transferred to the Central Southwest territory with headquarters at Kansas City.

**Hercules Motors Corp.**, Canton, Ohio, has opened an office in New York City, at Room 427, Chanin Bldg., 42nd St. and Lexington Ave., where C. P. Weekes, sales representative and manager of the Eastern territory will make his headquarters.

**Servicised Premoulded Products, Inc.**, Chicago, Ill., which operates fibrated asphalt products plants in Ohio, Illinois, Louisiana and Florida, has announced that a new plant, embracing 12 acres of ground and buildings, will be placed in service in Wilmington, Del.

# A Real Jack the Ripper

WHEN it came to a genuine ripping up job in Auburn, N. Y., Brayer Bros., contractors of that city, used a new model K2 Bay City full revolving shovel with great success. The job consisted of removing an old pavement and street car tracks, the surface being a combination of brick, concrete and macadam. The job was originally started with a steam machine, but the prompt and strenuous objections on the part of property owners resulted in the change to a gasoline shovel which eliminated the objectionable smoke and noise, as well as the damage to the old and beautiful shade trees.

The track was ripped up quickly by suspending the chain and roller yoke device from the bucket teeth, and fastening it to the front axle of the machine to hold it in position. The propelling power of the machine was then set in motion with the result that the track was pulled out of its foundation very quickly and economically. As soon as a block of rail had been removed, the shovel resumed excavation of the pavement surface. No hand labor was used for removing the rails, nor were they cut or burned into short sections for removal.

*The Ripper Device Used by Brayer Bros. for Removing Abandoned Street Car Tracks*

## Paver Poured Overpass

*(Continued from page 84)*

Water for the concrete was taken from the city mains through a 1-inch tap extended to the job and measured through a ½-inch meter. The water was of excellent quality and came from a spring at some distance from the city at high pressure. Normal pressure in the city is 130 pounds per square inch.

### Quantities and Prices

The contract called for 980 yards of concrete and 128,000 pounds of reinforcing steel. The bid prices were $19.00 per yard for reinforced concrete and $13.00 for plain concrete in footings. Excavation was handled at 80 cents per yard and the steel was 4½ cents a pound.

There were 5 carpenters and 15 laborers on the job, all white labor. A Parks saw rig with band saw and circular saw run by a LeRoi engine was used for cutting all the forms.

### Personnel

The contract was handled under the supervision of F. C. James, Assistant Engineer for this district, with S. J. Hall as Resident Engineer and B. S. Barnett as Inspector. A. D. Campbell was Superintendent for Longley & Co., Lexington, Ky.

# The Bulletin Board

## *New Lines Carried by Discributors of Construction Equipment*

*Additional information in regard to the lines carried by Distributors may be found in the Directory, pages* 129 *to* 156 *of this issue of* CONTRACTORS AND ENGINEERS MONTHLY.

**Kern-Limerick, Inc.**, 2800 West Fifteenth St., Little Rock, Ark., has recently added to its line the dredges and dredging machinery manufactured by the Ellicott Machinery Corp., Baltimore, Md.

**R. B. George Machinery Co.**, Dallas, Texas has taken on the contractors' equipment made by LaPlant Choate Manufacturing Co., Cedar Rapids, Iowa., and air compressors manufactured by the Gardner-Denver Co., Denver, Colo., in addition to the lines previously handled.

**Hendricks & Shultz, Inc.**, 486 Broadway, Albany, N. Y., has added the Atlas Engineering Co., Clintonville, Wisc., and Metalweld, Inc., Philadelphia, Penna., to its accounts.

**E. A. Martin Machinery Co.**, Joplin, Mo., has recently taken on the lines manufactured by the following companies: Euclid Crane & Hoist Co., Euclid, Ohio; Davey Compressor Co., Kent, Ohio; W-K-M Co., Houston, Texas; Willamette-Ersted Co., Portland, Oregon; Ingersoll-Rand Co., New York; B. F. Goodrich Rubber Co., Akron, Ohio; Illinois Powder Mfg. Co., St. Louis, Mo.; and the Sterling Machinery Corp., Kansas City, Mo.

**Bashford-McCord Corp.**, Rochester, N. Y., is now representing the Euclid Crane & Hoist Co., Euclid, Ohio, in addition to its other accounts.

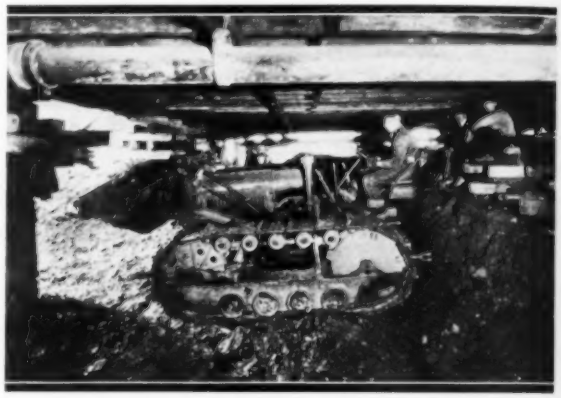
**F. Rondstadt Co.**, Tucson, Ariz., has changed the name of the firm to the **Rondstadt Hardware & Machinery Co.**, and has added the following to its line of equipment: Ord finishing machines, made by the Blaw-Knox Co., Pittsburgh, Penna.; Sterling hoists, manufactured by the Sterling Machinery Corp., Kansas City, Mo.; Broderick & Bascom Yellow Strand wire rope, a product of the Broderick & Bascom Rope Co., St. Louis, Mo.; Red Edge shovels and picks, made by the Wyoming Shovel Works, Wyoming, Penna.; and Myers pumps, manufactured by F. E. Myers & Bros. Co., Ashland, Ohio.

**W. A. Kuhlman & Co.**, 340-344 Water St., Toledo, Ohio, has added the following to its accounts: Jos. F. Kiesler Co., Chicago, Ill.; Bates Mfg. Co., Joliet, Ill.; Erie Steel Construction Co. Erie, Pa., and Construction Machinery Co., Waterloo, Iowa.

**B. Hayman Co., Inc.**, 118-128 N. Los Angeles St., Los Angeles, Calif., is now handling agricultural and industrial tractors of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., and the portable hoists made by the Willamette-Ersted Co., Portland, Ore., in addition to its other accounts.

**Neil B. McGinnis Co.**, 753 East Jackson St., Phoenix, Ariz., has taken on the following new lines of contractors' equipment in addition to the lines previously handled; Monarch tractors, made by the Monarch Tractors Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis.; Brenneis rippers and scarifiers, manufactured by the Brenneis Mfg. Co., Inc., Oxnard, Calif.; Servicised expansion joints, made by Servicised Premoulded Products, Inc., Chicago, Ill.; Snow King snow plows, a product of the Rotary Snow Plow Co., Minneapolis, Minn., as well as Jumbo wheel scrapers and Master rotary scrapers.

**R. S. Armstrong & Bro. Co.**, 676 Marietta St., N. W., Atlanta, Ga., has added Euclid scrapers and wagons, made by the Euclid Crane & Hoist Co., Euclid, Ohio, and Monarch tractors, product of the Monarch Tractors Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis., to its line of contractors' equipment.



*After Digging Its Way into the Basement This Shovel Had to Carry Each Load of Dirt* 50 *Feet to Dispose of It*

# Digging in Low Headroom

DIGGING a basement under a large shoe factory while 150 employees are at work and tons of heavy machines are in operation in the building is a job that taxes the ingenuity of the contractor, as H. C. Cole of Milwaukee, Wis., discovered recently when he undertook to execute a contract of this kind.

The job was begun by raising the building from its foundation to a height of several feet and supporting it on blocks, as the picture shows. Even then, however, there was not enough room for men with shovels to work under the building, and it was up to the contractor to find some kind of equipment that would do the trick.

Steam shovels or any other tall machines were out of the question under the conditions. A Trackson McCormick-Deering shovel unit was then tried out. This shovel is able to dig to a depth of 8 inches below ground level and by beginning at the very edge of the building the machine literally dug itself into the space under it.

The contract was finished in six 10-hour days, with the tractor-shovel digging and moving a total of 500 yards of dirt. Each load of dirt was carried about 50 feet before it was dumped. A great deal of time was lost, too, by waiting for the block to be moved from time to time and for the placing of additional supports as the dirt was dug out from under the building.

Because of its low overhead clearance, flexibility, and short turning radius this shovel unit proved ideal for this job, where the slightest jar to the supporting blocks might have proved disastrous.

*The Littleford Rotary Sand Dryer*

# A New Rotary Sand Dryer

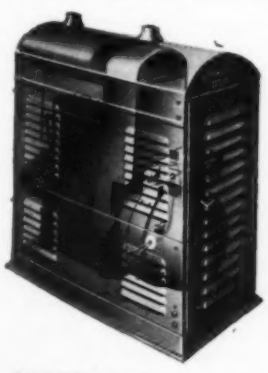
A ROTARY sand dryer capable of turning out 20 cubic yards per day and known as No. 89, has been developed by Littleford Bros., 485 East Pearl St., Cincinnati, Ohio. The wet sand is shoveled into the loading hopper of the dryer and is automatically fed into the revolving cylinder by means of a special conveyor. As the sand passes through the revolving cylinder, it is cascaded from one flight to another. Heat from three Littleford torch-type oil burners passes through the cylinder thoroughly heating the sand.

The revolving cylinder is driven by an air-cooled engine. Hot air from the fan after it has passed around and cooled the motor, is driven through the cylinder. Heat from the burners and air from the engine enter the cylinder at the discharge end. All moisture or steam generated by the heat in contact with wet sand is driven out by the hot air. When the sand tumbles out at the end of the cylinder, it is dry.

This oil-burning, motor-driven rotary sand dryer is capable of producing 20 cubic yards of dry sand per 10-hour day, the sand having an initial moisture content of not more than 5 per cent with the outside temperature not lower than 40 degrees Fahrenheit.

# A New Field Electric Plant with Weatherproof Housing

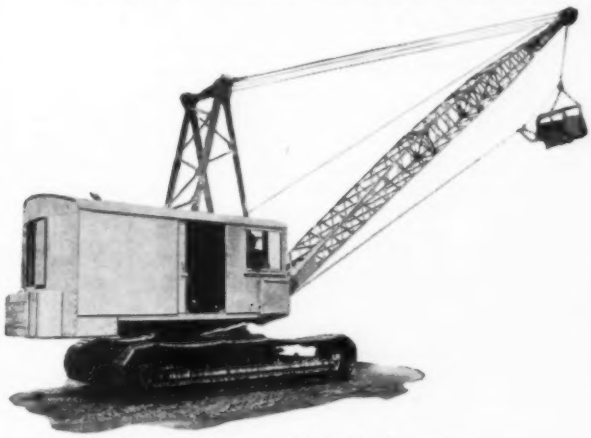
CONSTRUCTION and excavating contractors and others have found that by the use of electric plants they can make night work profitable and safe, as it is possible to light up the entire working area as bright as day. Walks and roadways may be illuminated and pitfalls marked. The new Model EH Kohler electric plant made by the Kohler Co., Kohler, Wis., carries its housing with it for tough outdoor jobs regardless of the weather. It measures 20 inches wide, 37 inches long and 41 inches high, and has a 1½-kw capacity, sufficient for six 250-watt lights, sixty 25-watt lamps or the equivalent in electric power. A strong sheet metal housing protects its 4-cylinder, 4-cycle, 1,000-rpm engine and direct-connected generator from rain and snow. Hooded vents provide for ample ventilation for cooling even in summer heat. Removable sides and ends make all parts readily accessible. The plant can be started and stopped without removing any of the sides or ends. It is complete and self-contained and has a gasoline tank built into the housing. Lubrication is by the forced system to the crankshaft, camshaft, shaft and rocker arm bearings, and the engine is water-cooled. Ignition is with a high tension magneto, the governor is mechanical throttling and the fuel supply is by gravity from the built-in tank. The generator is a sturdy, 4-pole compound wound 110-volt direct current unit, and the housing is of sheet iron with cast iron base and angle iron post.



*Model EH Kohler Electric Plant*

# A 2-Cubic Yard Dragline for General Construction Work

TO meet the need for a large mobile dragline for drainage and general construction work, the Northwest Engineering Co., 28 East Jackson Blvd., Chicago, Ill., has recently announced a new 2-cubic yard machine. This unit handles a 2-cubic yard bucket on a 50-foot boom at a 40-foot radius and is equipped with crawlers 17 feet 5 inches long and treads 33 inches wide. This gives an unusually large bearing area capable of carrying the machine over extremely soft going.



*The New Northwest 2-Cubic Yard Dragline*

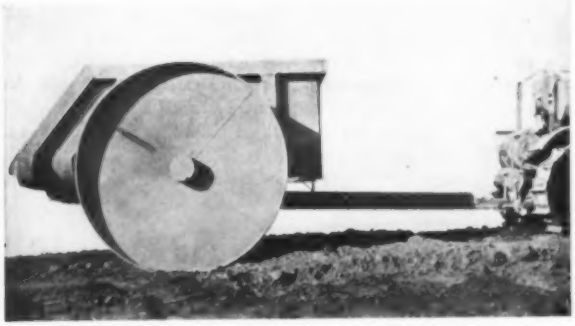
The power plant is the Northwest variable speed motor, accelerator controlled. Clutches are shifted through the feather-touch control, all high speed shafts are mounted on ball bearings, the drive from the engine is through helical gears mounted on ball and roller bearings and running in oil and positive traction assures easy maneuvering.

# A High Pressure Pump for Contractors

THE outstanding features of the Friend high pressure contractors' pumps made by the Friend Mfg. Co., Gasport, N. Y., are compactness and light weight.

It is equipped with the Friend quadruplex deep oil bath high pressure pump and has a capacity of 45 gallons per minute at any desired working pressure. It has full roller bearing equipment all working in a deep oil bath, direct line plungers, frictionless roller bearing adaptation of the Scotch yoke drive and cut gear transmission direct from the motor. The automatic pressure pump is driven by a 15-horsepower LeRoi motor and has a substantial cab with provision for locking. The cab is 6 feet long, 4 feet high and 5 2/3 feet high. Its approximate shipping weight is 2,385 pounds.

A particular advantage of the light weight is found in the ability to move it under certain conditions by hand without the use of horses or tractor. It is furnished with either steel or rubber-tired wheels.



*The Le Tourneau 12-Yard Chariot-Type Dump Cart*

# A New Two-Wheel 12-Yard Dump Cart

OUT of the West has come another innovation in dirt moving in the LeTourneau chariot-type dump cart made by R. G. LeTourneau, 122 Moss Ave., Stockton, Calif. The cart is built of high grade metal throughout, and is rugged enough to stand rough treatment, weighing approximately 7 tons when empty. It is easily dumped by means of a power controlled unit operated by the tractor driver. No castings are used, and it is entirely of plate steel electrically arc welded. Therefore, there is no loss of time for repairs and upkeep is minimized. The operator has a clear vision under the axle and can dump in a pile or spread out his load by backing up his cart.

The axles are 6-inch heat-treated alloy steel and extra large Timken bearings are used. The wheels are 78 inches in diameter with a 30-inch face, which make it possible to travel over nearly as soft a material as with tracks and yet eliminate the expense and upkeep of tracks. Used in connection with a dragline, this machine is particularly advantageous, as the body is 9 x 11 x 4 feet, holding 12 yards water level or 16 yards heaped up. Another advantage is where rocks broken up by dynamite are large. As soon as a shovel can pick them up they can be loaded into the cart and quickly hauled away.

# Gas-Electric Locomotives

A NEW line of gas-electric locomotives has recently been introduced by the Vulcan Iron Works, Wilkes-Barre, Penna. The 12-ton narrow gage locomotive, shown in the illustration, is powered with a 120-horsepower Buda 6-cylinder gasoline engine direct connected to a 250-volt D. C. shunt wound generator for furnishing electric energy to the two Westinghouse mine haulage motors geared to the axles.

It is provided with a combination throttle and motor control. The controller has two handles, the speed handle which controls the electric-magnetic switches, operates the engine throttle, regulates the generator field excitation, and the starting, accelerating and speed of the locomotive. A separate reverser handle is provided for connecting the motors in series or parallel positions, and for reverse or forward directions. The movement of the speed handle from the "off" to the "pump" position speeds up the engine for operating the air compressor without running the locomotive.

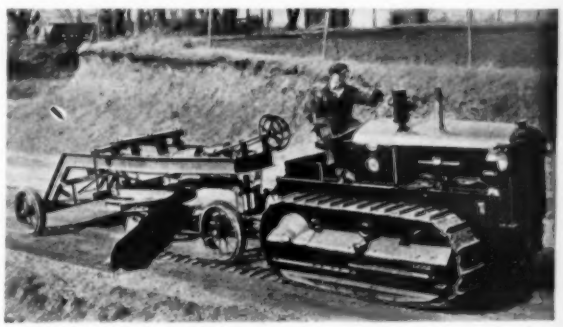
*The Vulcan 12-Ton Narrow Gage Gas-Electric Locomotive*

This new model has Vulcan standard cast steel bar type frames, steel tired wheels 30 inches in diameter, steel plate bumpers, a cast steel single pocket coupler with spring draft gear, semi-elliptic springs cross equalized, four steel sand boxes equipped with air sanders, brakes applied through the Westinghouse air brake equipment and auxiliary hand lever, a steel cab with double glass windows and an exhaust heater furnished for use in cold climates. The locomotive is compactly built, being 13 feet 6 inches long over the bumpers, 7 feet wide and 8 feet high. It has a maximum speed of between 18 to 20 miles per hour.

These locomotives are furnished in sizes from 10-ton to 40-ton in the 4-wheel type and in the 8-wheel type from 20-ton to 80-ton in all practical gages.

# Two New One-Man Graders

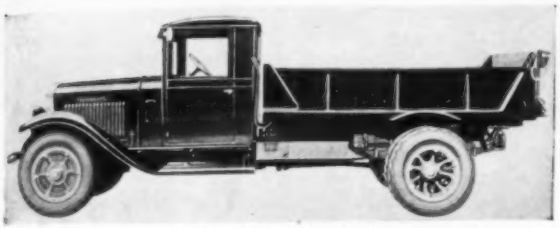
TWO new one-man graders have been adapted for use with the Allis-Chalmers Monarch 35 tractors by the Shaw-Enochs Tractor Co., Stillwater, Minn. One of these graders, the Century, is designed for both maintenance and construction, and can be changed into a two-man unit if desired. According to the manufacturer, the Century, propelled by a Monarch 35, makes a powerful one-man maintainer, heavy enough for construction work. The tractor, which can easily be detached from the grader by lifting a hitch pin, has ample power for snow removal and various other types of tractor work required by both municipalities and contractors.



*A Monarch 35 with a Century Grader*

A new feature of this grader is its reversible control. When the grader is used as a one-man maintainer the controls are placed in front within easy reach of the tractor seat. For use as a two-man unit, the blade controls can be transferred to the rear of the grader in less than an hour's time and without additional parts.

The other grader, the Shawnee No. 2, is especially adapted to heavy maintenance, scarifying city streets and roads having heavy traffic. With the Monarch 35 this grader is also used by paving contractors as a subgrade maintainer and subgrading grader to work ahead of the paver. The grader is also adapted to cutting form trenches. It develops a blade pressure up to more than 5,000 pounds, depending upon the size of blades and equipment used. It will handle blades up to 16 feet in length. The blade is integral to the frame, and the entire frame is raised through a crank axle mounted on Timken roller bearings. The blade is adjusted with large screws housed in seamless steel tubes, one telescoping over the other.



*The New Model A-5 International Harvester 3-Ton Speed Truck Equipped with Dump Body*

# Speed Truck of 3-Ton Capacity

THE new Model A-5 3-ton speed truck recently announced by the International Harvester Co., 606 South Michigan Ave., Chicago, Ill., is designed to meet a wide range of hauling requirements. It is built in four wheelbases, 156-inch for dump and semi-trailer service; 170, 190 and 210-inch for general hauling of all kinds. The longer wheelbases provide for maximum body lengths back of the cab of 13, 15 and 17 feet 6 inches, respectively. On the 156-inch wheelbase chassis it is possible to mount 2½-yard dump bodies 9 feet or 9 feet 6 inches in length.

Some of the outstanding features of the new truck are a new 6-cylinder engine with 7-bearing crankshaft, 7-bearing camshaft and removable cylinders; a single-plate clutch with built-in vibration damper; a new and exclusive transmission with 5 speeds forward and one reverse; new spiral bevel gear drive axle; mechanical four-wheel brakes and heavy pressed steel channel tapered frames.

Force-feed lubrication is used, the gear type oil pump, driven from the camshaft supplying oil under pressure to all main, connecting rod, camshaft and rocker arm bearings. All lubricant passes through the oil filter, which is of the latest type. One of the interesting features of the lubricating system is the absence of pipes, the drilled camshaft acting as the oil distribution manifold.

The centrifugal water pump, attached directly to the cylinder head, delivers water from the radiator to the water jacket at the rate of 1 gallon per horsepower through the entire speed range of the engine.

# A New and Speedy Tractor Crane

SPEED in hoisting and handling material is a feature of the new tractor crane recently announced by the N. P. Nelson Iron Works, Passaic, N. J. Power for this crane is supplied by a McCormick-Deering No. 20 industrial tractor, the wheel base being lengthened to 98 inches and the width across the traction wheels increased to 89 inches. The four usual forward speeds of the tractor have been retained and one speed in reverse. The tractor is suspended in the chassis by the rear axle housing and the front axle pivot. The crane is stable for its rated load and reach without chocking the front axle so that with its three-point support it can work on uneven ground with ease and safety.

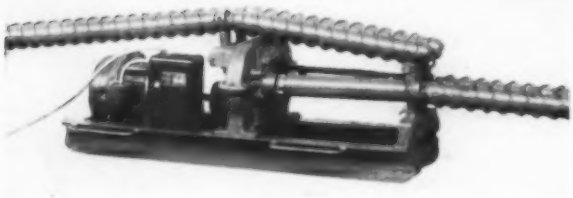
A direct drive from the tractor engine makes the crane's motions independent of the transmission and the clutch controlling the travel, so that hoisting, topping and swinging may be performed simultaneously with travel forward or back without interruption by shifting gears. The entire crane mechanism can be cut off by the master clutch on the direct drive. Reduction gears, with reversing clutches for topping and swing, are enclosed in two heavy cast iron oil-housings which are carried one on each side outside the frame. By taking out eight accessible bolts either gear box may be removed without disturbing the hoisting or topping drum shafts which remain mounted between the frames.

Topping and swing motions are reversed by pairs of oversize friction clutches controlling self-locking cut worm gearing. The swing unit terminates in a sprocket drive to bevel gearing under the mast, while an open crab coupling on the topping unit engages the end of the topping drum shaft. Reduction gears for driving the hoisting drum terminates in a stub shaft carrying a similar crab coupling on the inner face of the box and a capstan-head on the outer face.

The hoist-drum shaft is located directly under the mast, and carries a 14-inch free shifting drum with an asbestos-faced cone clutch, ample foot brake and a pawl for holding the load. The thrust screw is formed by a pair of heavy iron castings with a carefully cut square thread and separate provision for lubrication. The drum itself is mounted on large Timken roller bearings, and a separate Timken thrust collar is placed between the drum and the thrust screw. The hoisting drum is geared to give a hoisting speed of 200 feet a minute on the single line with the engine at full throttle speed of 1,000 rpm. Loads of 1,000 pounds can be handled with speed and ease within the 17½-foot maximum radius of the crane. Loads up to 2,000 pounds can be handled within a 10-foot radius, and directly in front the crane will pick up loads of 3,000 pounds, though these should not be swung to the side.

The mast is a steel casting which revolves on double ball bearings 21 inches in diameter mounted in a cast steel base. Two lines run to the rooster, one line being the four-part topping rig and the other the hoisting line. For general service a weighted fall block is provided, which may be used as a deadweight to overhaul the single hoisting line for loads under 1,000 pounds, and which can be quickly changed to make a two-part fall for handling heavier loads. The telescoping boom is adjustable between 12 and 17 feet in length, two heavy fins being provided for safety. The spar is fabricated from welded steel plates and carries a gooseneck at the peak. With the boom lowered the height from the floor to the top of the rooster is 9½ feet.

*The New Nelson Tractor Crane Mounted on a McCormick-Deering Industrial Tractor*



*A Hurdle Section of the TwinVeyor*

# A New Type of Conveyor

A NEW portable flexible power driven elevating and tiering conveyor has been announced by the Clark Tructractor Co., Battle Creek, Mich. The Clark TwinVeyor uses a new principle. Two external spiral tubes are turned toward each other by a power head. Anything such as a bag of cement placed on the conveyor travels forward rapidly, perfectly balanced. A standard unit consists of six 8-foot dual sections and a power head. Each section is light, and joins to the assembly with an automatic lock. It is easily shifted about by one man, and the entire 50-foot line can be assembled or disassembled in 6 minutes. Flexibility is secured by the ability of any joint to take a 15-degree angle horizontally or it may be tilted 15 degrees up or 10 degrees down.

A hurdle section, such as is illustrated, permits any number of TwinVeyor 50-foot units to be hooked together to form a continuous line of any desired length. The traveling load hurdles each power head in the line. An extension cord attached to the power head may be plugged into any power line.

# An Improved Road Roller

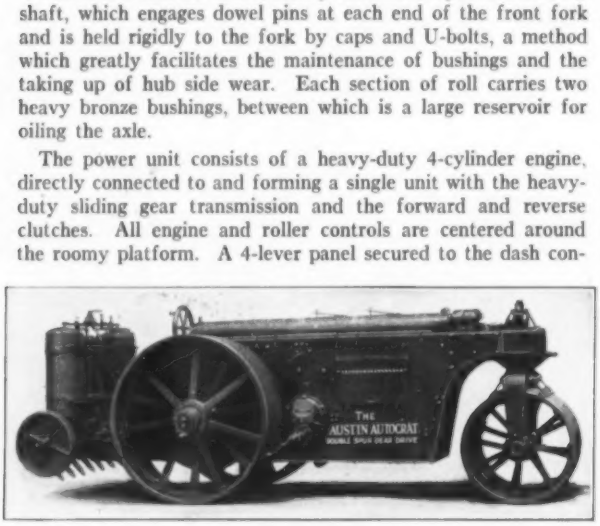
ONE of the outstanding features of the new Austin Autocrat road roller, recently announced by the Austin-Western Road Machinery Co., Chicago, Ill., is a double spur gear drive of exceptional efficiency. The improved roller has an unusually short wheel base, which adds greatly to its maneuverability in close quarters, and a low center of gravity insures smooth work by eliminating side sway.

The front rolls of the machine are 43 inches in diameter and have a combined width of 40½ inches. They are fitted with scrapers carried on lugs integral with the fork and held close to the rolls by spring pressure, which can be quickly adjusted to any desired tension.

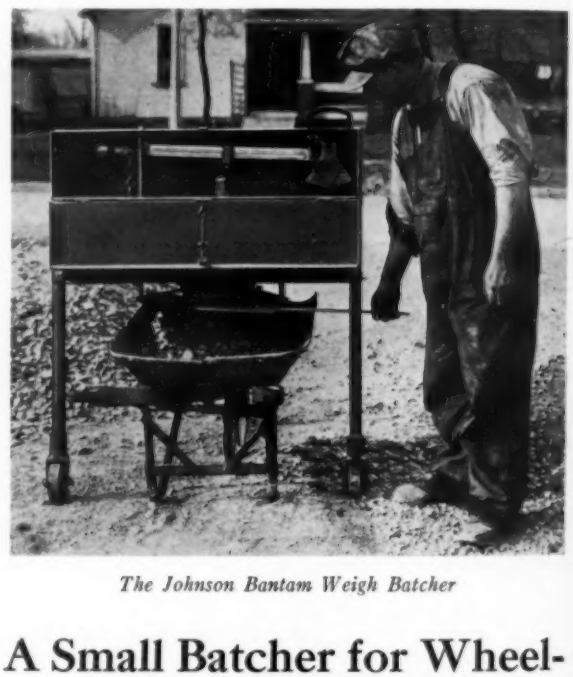
The front axle is an accurately machined open-hearth steel shaft, which engages dowel pins at each end of the front fork and is held rigidly to the fork by caps and U-bolts, a method which greatly facilitates the maintenance of bushings and the taking up of hub side wear. Each section of roll carries two heavy bronze bushings, between which is a large reservoir for oiling the axle.

The power unit consists of a heavy-duty 4-cylinder engine, directly connected to and forming a single unit with the heavy-duty sliding gear transmission and the forward and reverse clutches. All engine and roller controls are centered around the roomy platform. A 4-lever panel secured to the dash contains the spark, throttle, choke and governor controls, while the oil pressure gage is located just below and to the right of this panel. The transmission change speed lever operates on a quadrant secured to the center of the dash. The clutch lever is pivoted to the left side of the dash plate, while the foot brake lever is pivoted to the front of the dash within easy reach of the operator. The steering wheel is conveniently located just below the top of the dash, and as the steering shaft passes under the hatches and through the upper radiator tank to the steering gear, the operator has equally good vision on both sides of the roller.

Other features of the roller are a large radiator with ample cooling capacity for the motor and for the scarifier air compressor, a 30-gallon gasoline tank mounted close to the dash and high enough to provide gravity feed to the carburetor, a double acting foot brake of the cam actuating type located on the third shaft of the transmission with lever conveniently located for the operator, and an unusually large tool box located beneath the foot plate, the lid forming a portion of the plate itself and provided with a padlock.




*The Autocrat Road Roller*



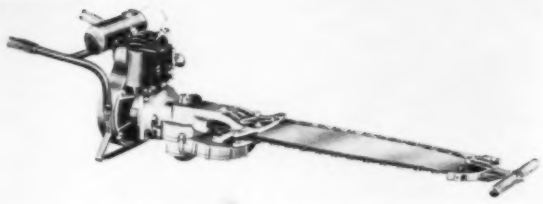
*The Johnson Bantam Weigh Batcher*

# A Small Batcher for Wheelbarrow Batching

THE Johnson Bantam Weigh batcher for wheelbarrow batching of accurately weighed aggregates on building, culvert, small bridge, curb and gutter work and such jobs where the setting up of a complete bin and batching unit is not justified, is manufactured by the C. S. Johnson Co., Champaign, Ill. Weighing but 280 pounds, this batcher can be loaded or unloaded easily from trucks, is mounted on two large diameter wheels and can be moved around on the job by one man. The shoveling height is 42 inches, and its capacity is 4 cubic feet, 400 pounds, or 6 cubic feet, 600 pounds, a full wheelbarrow load.

The discharge is a simple sliding gate with nothing to get out of order and high enough for any standard wheelbarrow. The hopper is round and free from any obstructions, and only the material directly in it affects the weight.

The outstanding feature of the Johnson batcher is the weighing unit. The scale parts are entirely of bronze for durability and service. The beam balance indicator, warning the operator of approaching balance, balance and overload can be read from either side.



*The Wolf Gasoline Driven Saw in Horizontal Cutting Position*

# Two New Gasoline Driven Saws

TWO new saws, with 16 and 24-inch blades, respectively, and powered with gasoline engines, have recently been announced by the Reed-Prentice Corp., Worcester, Mass. These new Wolf saws have the same chain, saw frame and drive units as the Wolf electric and air driven machines, but they are powered by a 4-horsepower air-cooled single-cylinder two-cycle gasoline motor, equipped with a Bosch magneto and gasoline tank carrying approximately two quarts of gasoline and oil, consisting of one part good grade machine or cylinder oil and nine parts of gasoline. This mixture is poured directly into the tank.

The engine is of high grade construction, the crankshaft being drop forged. The main bearings are ball bearings, while the connecting rod, made from drop forging, is of roller bearing type on the main crankshaft bearing, the main bearing being hardened to give longer life. The throttle is operated from the left-hand handle. In order to stop and start the chain independent of the motor a multiple disc clutch is furnished, engaged and disengaged with a lever. Whenever the saw has a tendency to stall the clutch will slip rather than stall the motor.

The saw is made with a swivel movement so that cutting can be performed either vertically or horizontally, allowing the engine to remain in a vertical position. The motor is started with a rope wound on a pulley.

# Portable Air Compressors Equipped with Oil-Cooled Engines

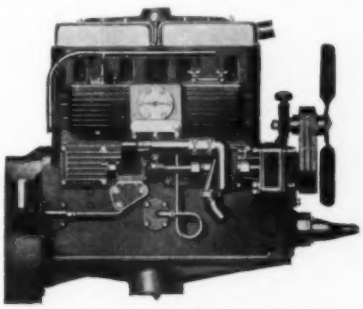
A RECENT development in the line of Metalweld-Worthington portable air compressors, manufactured by Metalweld, Inc., 26th and Hunting Park Ave., Philadelphia, Penna., is the adoption of the H-Model Continental engine as the power unit for all 220, 280 and 330-cubic foot displacement compressors. The feature of this engine is the oil circulation, which was developed for the purpose of reducing operating temperature, a vital factor in air compressor use. The manufacturers state that actual tests have shown reductions in the temperature of circulating oil as great as 35 degrees Fahrenheit.

*A Metalweld-Worthington 330-Cubic Foot Unit*

The dry sump system is used in this engine, a special aluminum oil reservoir having been mounted high on the side of the engine block. This reservoir is provided with a series of cooling fins and is located directly in the cool air path from the fan. A liberal air space is also allowed between the reservoir and the engine. A separate low pressure pump takes the oil as rapidly as it collects in the bottom of the pan and forces it up to the reservoir, where it first passes through a metallic disc filter set in a separate built-in, open-top filter compartment of the reservoir. In this filter the oil is forced between a series of centerless discs which alternate with a series of copper wiper plates. Any foreign matter in the oil lodges between these discs, and can be removed daily turning a handle located at the outside of the reservoir which rotates the metal discs against the stationary wiper plates. The dirt collects in the cleaner compartment, and may be drained off separately without disturbing the clean lubricating oil. The cleaned oil overflows from the cleaner compartment into the reservoir proper, whence it flows by gravity to the high pressure oil pump for recirculation to the main bearings and all bearing surfaces.

Another feature of the H-Model engines is the removable cylinder sleeves. These sleeves can be replaced at a minimum of cost and eliminate the trouble of ordering oversize parts as well as the prohibitive cost of reboring cylinders.

Other new additions to the Metalweld-Worthington compressor include a primer pump for cold weather starting. A rich gas vapor is forced into each cylinder instead of using the choke. The air cleaners are furnished with each unit, one for the engine and one for the compressor. A gas filter has also been added as well as a magnetic gasoline gage.



*The New H-Model Continental Engine Which Furnishes Power for the Metalweld-Worthington Units*

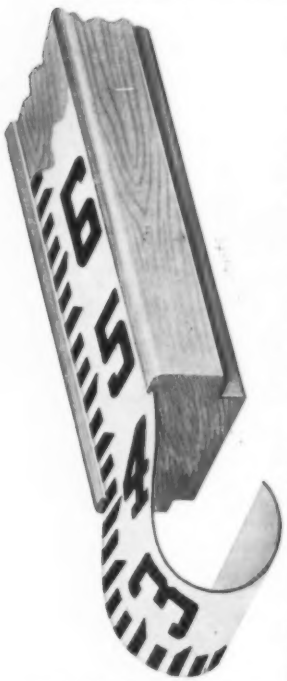
# A New Device for Testing the Viscosity of Engine Oils

THE viscosity of diesel engine lubricating oils, which vary considerably from one brand to another and are subject to further fluctuations throughout the service life of the oils, can now be tested by an automatic Viscosimeter, recently developed by the American Viscosimeter Co., 110 East 42nd St., New York. The instrument consists essentially of an ordinary pressure gage measuring the head set up by oil flowing through a friction tube at a rate held constant by a diaphragm and ball check arranged somewhat as in an ordinary reducing valve. The seating of the ball valve is controlled by a point on the diaphragm button, while oil can flow between the ball and its seat into the space above the diaphragm. The latter has a small calibrated hole through which the oil can get underneath the diaphragm and from there to the calibrated outlet tube at the left. The space between the diaphragm and the outlet is connected to the pressure gage, whose readings measure the true viscosity and can be read on the dial by anyone.

The instrument has three connections—the inlet, the outlet and the connection to the pressure gage calibrated to read in viscosity units. The inlet can be connected by piping or tubing to any convenient point on the discharge line from the force feed circulating pump, while the oil returning from the instrument can be led to any suitable point in the engine crankcase or oil drain. Although the instrument is provided with a standard pipe plug at the outlet to permit of its being tapped directly into the crankcase, almost any other convenient location may be selected, while the position of the gage may be chosen without restrictions. In most cases it would be mounted on the panel with other pressure gages and so forth regularly used for safeguarding the engine.

Operators of diesel engine plants should find this Viscosimeter a valuable safeguard in the use of diesel engines, and are enabled by its use to quickly correlate such factors as bearing wear and the condition of their surfaces with the true viscosity of the oils they are using.

# A New Leveling Rod



*Method of Inserting Strip*

A NEW leveling rod, on which the graduations and numbers are applied directly upon a durable, corrosion-resisting metal strip with a permanent white enameled face securely attached to the rod, yet easily replaceable, is made by Keuffel & Esser Co., Hoboken, N. J. The graduations are sharply defined in black. Numerals are in red for the main divisions, such as feet, and the subdivisions are in black. The graduations on the metal strip of the Metagrad rod will last longer, and the strip can readily be replaced if ultimately it should show wear.

The entire metal strip is graduated, numbered and finished before it is attached to the rod, which, as in the case of the precise geodetic rod, serves merely as a support. This feature lengthens the useful life of the leveling rod.

# Portable Bin Equipped with Clamshell Gates

A NEW portable bin having some new and unusual features has recently been announced by the James Seaverns Co., Batavia, Ill. These bins, which are of 50-ton capacity, and, with the batcher, weigh 6 tons, are so built that assembling or dismantling them requires a minimum amount of time. The four supporting legs are provided with hinge joints, so that they may readily be secured in place without the necessity of holding the leg independently to align the holes for the insertion of bolts. The top of the bin can be detached if necessary. The bin proper, which is 8 feet in width, is of 30-ton capacity without the top, and has a partition in the center to facilitate the spotting of the bucket by the crane operator.

The compartments are divided to allow about 60 per cent for stone and 40 per cent for sand. On the bottom line of the batchers is arranged a wooden platform from which the operator manipulates the clamshell gates which control the flow

*The New Seaverns Portable Bin*

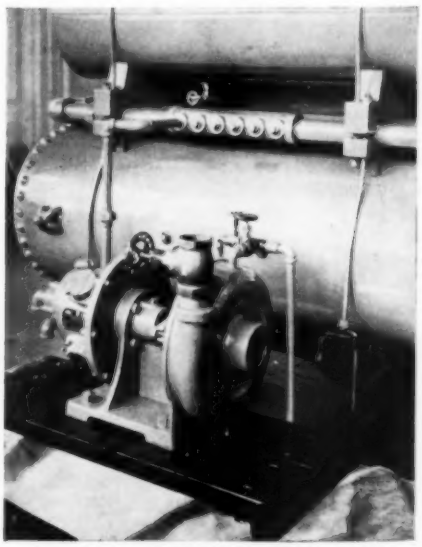
of the aggregate from the bin above to the separate batchers below. The batch hoppers are provided with U. S. standard scales, and the clamshell gates, which are one of the features of the unit, are so arranged that a slight jerk of the lever will bring the dial to zero or within a pound of the desired weight.

# An Air-Motor-Driven Pump

A NEW air-motor-driven pump, of the Cameron single-stage, single suction, open-impeller, volute type, driven by a 4-cylinder air motor, has recently been announced by Ingersoll-Rand Co., 11 Broadway, New York. This pump, which is known as the ACV, can be mounted on a shelf at the rear of a portable air compressor. In this position the connecting pipe between the air receiver and the motor will not interfere with the hose line supplying air to the drills.

The unit is positive in action, and proves useful in dewatering trenches or excavations which have become filled over night. It also keeps the workings free from water caused by surface drainage or seepage while the men are at work.

The capacity of the pump, with 60 pounds air pressure at 1,000 rpm, is 130 gpm against a 29-foot head. With 80 pounds air pressure at 1,200 rpm, the capacity is 125 gpm against a 43-foot head, based on a 20-foot suction lift.

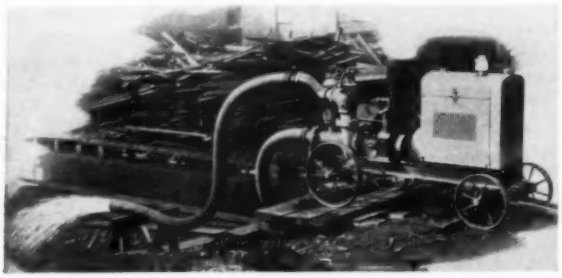


*The Ingersoll-Rand ACV Pump*

# A Self-Priming Pump That Maintains Its Prime

ON many pumping jobs there are times when there is very little water in the hole one minute and the next the water may rush in and fill up the excavation. The pump used on the job must be ready to take care of the increase of water without additional attention. Of this type is the new self-priming pump recently developed by the Chain Belt Co., 766 Park St., Milwaukee, Wis., which maintains its prime.

This new pump requires no attention even if the water goes below the end of the hose, as the vacuum is maintained automatically. As soon as the water begins to drop the vacuum pump begins to exhaust the air and pick up the prime again. By a special design of this pump the air pockets ordinarily found at the hub of the centrifugal vanes are removed before they can be sealed and interfere with the pump's prime. The pump may be used in excavations up to 27 feet in depth and maintains its prime and lifting capacity.



*The New Chain Belt Self-Priming Centrifugal Pump*

# A New Chemical for the Prevention of Freezing in Pneumatic Tools

A FIELD survey shows that only one in twenty air tools is operating at full efficiency, because wherever air is used expansively frost is taking the pep from air equipment, slowing up even the most aggressive workmen. Of considerable interest, therefore, to contractors and users of pneumatic machinery is the new anti-freeze system of Tannergas, the sales rights for which were recently secured by the Sullivan Machinery Co., 400 North Michigan Ave., Chicago, Ill.

The device consists of a tank known as the Tanner-tank, and by-pass piping connected into the air line near the point of use. This tank contains a liquid chemical which forms a gas, Tannergas, on combination with the compressed air in the top of the tank. This gas is carried into the air lines and is the active agent which prevents the freezing at the tools. The freezing point of the liquid is 70 degrees below zero.

The accompanying diagram illustrates the Tanner system. A joint in the main line is opened and the ends attached to the connector pipes which are a part of the Tanner-tank. The tank is then partially filled with Tannergas in the liquid form, as shown in the diagram. When the tank is in operation the upper valve is open and the lower one closed. The air is deflected through the by-pass at the lower left-hand tee, and into the tank. As it blows on the surface of the liquid in the tank, Tannergas is released to mix with the air flowing out of the tank and back into the main air line. The gas does not settle into the low places of the lines, but is blown with the air into every crack and crevice, saturating all the moisture along the line and the tools.

To prevent dilution of the liquid in the tank, the lower valve

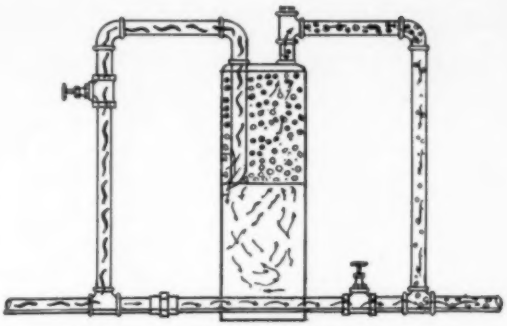


*Diagram Illustrating the Tannergas System*

is constructed so as to let a small quantity of air pass through, carrying with it the moisture which is in the bottom of the line. This small quantity of air, with the moisture, is rejoined by the main body of air and the moisture saturated by the Tannergas. To conserve the gas when it is not needed to prevent tools from freezing, the valves can be reversed and the air allowed to pass by the tank containing the liquid.

Tannergas is harmless, non-explosive, ordorless, does not wash off lubrication or affect paint in spray guns, does not affect hose, gaskets or metal, and does not require any change in present equipment.

# A Compact 5-Ton Hoist

A STEEL hoist which weighs little more than 20 common bricks and can be transferred quickly and easily to places difficult of access to the larger equipment which this hoist displaces, and which will handle loads up to 5 tons, is being made by the Beckwith Machine Co., Ravenna, Ohio. The Beckwith 5-ton Wonder hoist is made of high grade electrical furnace steel of high tensile strength. There are three major moving parts, the drum, the intermediate gear and driving pinion, all of which are mounted in a strong but light frame and they revolve in large, heavy-duty anti-friction babbitted bearings. The frame is provided with a 6-point bearing contact which gives a firm, safe foundation to overcome twisting under stress. The self-locking dog is strong enough to withstand any overload and is so designed as to prevent slipping. The brake is an external contracting type machined, being 10 inches in diameter by 1½ inches wide, 90 per cent of the circumference being in contact which makes for ease of operation and keeps the 5-ton load always under control.

The cable can be led off from any angle, as there are no obstructions offering interference. A tail yoke can be furnished so that the hoist can be anchored where a firm foundation cannot be obtained and the load can be transmitted through the hoist itself.

*A Moore Speedcrane Unloading Sand from Barges at the Yard of the Mamaroneck Sand & Gravel Co., Mamaroneck, N. Y.*

# Use of Alloy Steel Feature of New Heavy Duty Trailers

A NUMBER of new and improved features have been incorporated into the design of the Rogers heavy duty trailers manufactured by Rogers Bros. Corp., Albion, Penna. One of these features is the use of alloy steel, which is lighter in weight and has a 50 per cent greater carrying capacity than the structural steel sections formerly used in the frame members. The use of this steel makes it possible to reduce the weight of the trailer and still retain the same strength, plus the regular factor of safety.

Another feature is an electric steel rocking axle housing of lighter weight, greater strength and more compact design. This new design of axle housing permits the use of a shorter axle, which increases its strength; lessens the distance from center to center of the wheels on each axle, thereby getting a better contact with the rubber on the pavement where roads have considerable contour, and makes the brake levers and Alemite fittings more accessible. With this new feature the trailer can be made narrower than before and now uses 28 x 16 tires, of a mould made exclusively for Rogers trailers. This allows 2 inches more rubber on each wheel.

*An Alloy Steel Wheel of the Type Used on the Rogers Trailers*

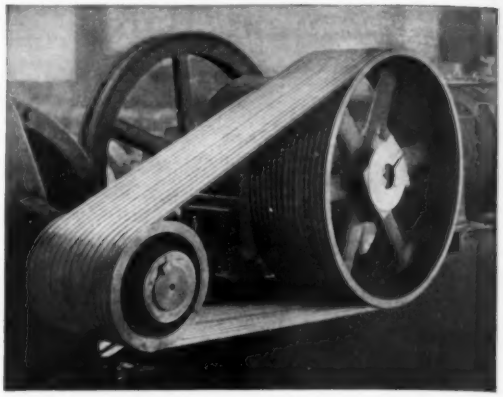
Electric steel wheels, the light weight of which reduces the total dead load, is another improvement. The rear wheels on the 15, 20 and 28-ton trailers are the single row spoke design and are of T shape. The rear wheels on the 35 and 45-ton trailers are the double row spoke design and are of cross shape.

The general design of the trailer has not been changed, but these improvements which have been made in it have resulted in a trailer of neater design, lighter weight and equal strength than former models.

# A New Drive for Power Transmission

AFTER months of study and experimentation in conjunction with the Goodyear Tire & Rubber Co., Akron, Ohio, the Worthington Pump & Machinery Co., Harrison, N. J., has recently placed the Multi-V-Drive on the market. This new drive for power transmission consists of a number of endless molded V-belts running in V-grooved sheaves, and combines a new long-life type of rubberized cord belt impervious to dust and moisture with an improved V-grooved sheave.

The Goodyear Emerald Cord belts used combine in the correct ratio high power capacity, long flexing life, low stretch and accurate cross-section. The load-carrying members are high-grade cotton cords arranged in parallel lines and concentrated about the neutral axis. The rubber is of the highest quality and each belt takes an equal share of the transmitted load. Each sheave is carefully grooved, machined and finished so that the grooves present a smooth surface on which the belts run. The wedging action between the belts and the grooves



*The Worthington Multi-V-Drive*

results in a slipless, powerful grip which compensates for, but differs from, initial belt tension in a flat belt drive.

The smooth-grooved construction of this drive, together with the fact that there is an exact mathematical relationship between the grooves and the molded shape of the V-belts, results in an effective conformity of belt to sheave which assures maximum power transmission efficiency. Where this drive is used there can be no sudden breakdowns, as each application is so engineered that, should one of the belts be ruptured, the remaining belts will carry the load until replacement is made.

# A New Crawler Loader

A NEW high-capacity crawler bucket loader, known as the Grizzly, 1930 model, has recently been announced by the Link-Belt Co., 910 South Michigan Avenue, Chicago, Ill.

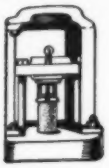
A special feature of this loader is the self-feeder which is of the continuous helical ribbon type and feeds and cleans up uniformly. The action of its self-sharpening spiral and correct cutting edge serves to cut, dig and convey the material to the elevator buckets in a smooth continuous stream. Adjustment of the feeder is controlled by a hand-wheel within easy reach of the operator, who rides with the machine on a conveniently located side platform.

The machine has a rated capacity of 1¾ cubic yards per minute on material 1½-inch and smaller. Larger stone may be handled at a somewhat smaller capacity. The power unit regularly includes a 30-horsepower Buda gasoline engine or a 20-horsepower electric motor for operating the bucket, elevator, feeder and the crawler traveling mechanism.

The crawler frames are one-piece steel castings. The crawler is wide and long to give the machine ample stability and is claimed to be self-cleaning.

*The New Link-Belt Crawler Loader*

# Whatever You Want in Curing-

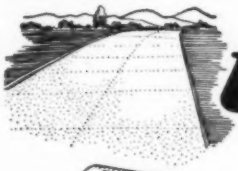


**Strength-**

*"Hunt Process curing produces concrete with compressive strengths equal to or greater than water curing.*

**Convenience-**

*Only one operation is required. All the work necessary is completed when you seal the surface with the film of "Hunt Process."*



**Uniformity -**

*Mechanical application assures absolute uniformity in curing. Film of "Hunt Process" covers every square yard without variation.*

**Low Cost -**

*Two men can cure your record day's run. No further attention is necessary, once the application has been made.*

**Quality -**

*"Hunt Process" was perfected for one purpose only, viz., to provide an ideal curing medium for concrete. No other material or method equals it.*

**"HUNT PROCESS"** meets your curing requirements no matter what they may be . . . meets them more satisfactorily, everything considered, than any other method. It is used by progressive engineers and contractors throughout the country on concrete work of every type, including pavements, retaining walls, bridges, pipe, flooring, etc. . . . The coupon will bring you an interesting booklet containing complete information. Send for it today.

**McEVERLAST, INC.**
[SEALED]

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35 E. Wacker Dr.
CHICAGO, ILL.

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1234 Athletic Club Bldg.
DALLAS, TEXAS

429 Russ Bldg.
SAN FRANCISCO, CALIF.

OFFICES IN PRINCIPAL CITIES

*Please send me your illustrated booklet and details of this better method of curing.*

Name_____

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City_____ State_____

C.E.M. Sept.

# A Light-Weight Pneumatic Sump Pump

A NEW light weight air-operated pump, known as the CP Quimby sump pump, has recently been announced by the Chicago Pneumatic Tool Co., 6 East 44th St., New York. This pump, which is driven by a CP No. 88 rotary air motor, is sturdily built, weighs but 44 pounds, and has a capacity of 100 gallons per minute at a 28-foot head. Steady capacities may be obtained with this pump up to 50 feet. All that is necessary is to start the motor running before submersion and lower the complete unit into the manhole or pit to be drained, and the water is pumped out without the necessity of first priming the pump. The exhaust air from the motor serves to rid the manhole or pit of dangerous gases and fumes while pumping.

By using a 2½-inch water hose for an outlet and a ¾-inch air line, this tool can easily be taken from job to job, making it a particularly convenient pump for use by contractors.

*The CP Quimby Pump*

# New Type of Distillate-Burning Engines Tested

TESTS of the new Climax 6 x 7 4-cylinder Blue Streak model distillate-burning gasoline type of engines manufactured by the Climax Engineering Co., Clinton, Iowa, were made recently by the engineering staff of the Armour Institute, Chicago. The Blue Streak engine used in this test was Model R-4-1, one of the eight sizes of its type. Furnace oil made by the Standard Oil Co. of Indiana was used in the test, power being reported without corrections for barometric or temperature conditions. Mercurial thermometers and a Leeds and Northrup potentiometer were included among the instruments used in securing the data. The following table of power and economy obtained with the use of the furnace oil was secured by the engineers in charge of the test:

*Testing the Climax Blue Streak Engine at Armour Institute*

POWER AND ECONOMY—FURNACE OIL

| RPM | BHP | Fuel BHP Hr. | Water Temp. Inlet | Water Temp. Outlet |
|---|---|---|---|---|
| 595 | 38.5 | .753 | 130 | 140 |
| 606 | 59.1 | .750 | 131 | 153 |
| 625 | 61.0 | .733 | 126 | 149 |
| 766 | 74.8 | .703 | 126 | 146 |
| 886 | 84.3 | .692 | 129 | 147 |
| 1009 | 92.7 | .677 | 138 | 150 |
| 1015 | 92.8 | .677 | 139 | 160 |

38.2 degrees A. P. I. at 60 degrees Fahrenheit—Cost in 100 gallon lots 8 cents per gallon, laid down at the Institute.

Several other complete tests of this Blue Streak line of engines have also been made recently. Average results show that the 6 x 7 4-cylinder model will develop 85 to 92 horsepower at approximately 1,000 rpm, depending on barometric conditions and the amount of heat used in the intake manifold. Flexibility requirements as well as power output were satisfactory in each case. One phase of the test showed that this engine easily delivered 90 horsepower at 1,000 rpm with a fuel rate of 0.7 pounds, or lower when operating under average conditions.

When gasoline was substituted for the distillate, the hot air pipe was removed and the carburetor readjusted for economy. The following table of results was given:

| RPM | BHP | Fuel No. 1 BHP Hr. | Water Temp. Inlet | Water Temp. Outlet |
|---|---|---|---|---|
| 565 | 56.8 | .641 | 117 | 145 |
| 730 | 71.8 | .603 | 126 | 148 |
| 920 | 86.5 | .587 | 136 | 156 |
| 992 | 93.2 | .585 | 122 | 141 |
| 1016 | 91.8 | .587 | 137 | 159 |

The above power was secured with the special low compression heads used for the distillate operation, and in spite of this unfavorable condition for gasoline operation the power and economy are exceedingly high.

# A Truck-Mounted Handyman Hoist

WHETHER a contractor is in the dirt moving game, building roads or structures, he always needs a hoist and if it is made mobile by attaching to a tractor it is all the more help to him. The Joliet International motor hoist made by the Joliet Manufacturing Co., Joliet, Ill., for mounting on a 10-20 McCormick-Deering tractor has proved helpful to many contractors.

The Joliet-International tractor hoist is built of rugged steel construction throughout with hardened machine cut gears, ball bearings, steel housings and many alloy steel working parts, all made to get the greatest efficiency in pulling from the 25-horsepower tractor motor. Plain babbitt bearings have been replaced on this hoist with self-aligning ball bearings operated in dustproof compartments and lubricated with an Alemite oiling system. All of the gears are of steel with broad faced stub teeth and every gear is machine cut. The large brakes and powerful clutches are made to withstand double the duty they are called upon to perform, reducing wear and replacement to a minimum.

An ordinary mechanic can easily mount the Joliet-International hoist on an industrial tractor in a very short time. The line pull on the lower drum is 5,500 pounds and on the upper drum 4,500 pounds, while the approximate hoisting speeds are 125 feet and 140 feet per minute, respectively.

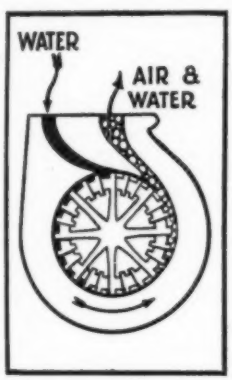
Because of its easy portability this tractor hoist will perform many tasks usually done with a 5-ton tractor, such as pulling trucks, trees, stumps, heavy rocks, and backfilling ditches.

This company has steadfastly refrained from implications and claims which, while literally true, might mislead the readers of its advertising. This series of advertisements will set forth some facts which, we hope, will assist our readers to positive assurance concerning the most satisfactory solutions of their pumping problems.

THE LABOUR CO., INC.
H. E. LaBour

# Not a Single Valve of Any Kind to Wear or Fail!

TO the extreme simplicity of the centrifugal pump, LaBour has added no complications in perfecting a centrifugal pump to handle air as well as water—one which will actually exhaust an air-filled suction line. In the LaBour Pump this is accomplished without the recirculation of a single drop of water after prime has been established, and yet *there is no valve of any kind!* LaBour, alone, offers a pump with this tremendous advantage.



PRIMING

In suction lift pumping, air is entrained with the water and when there is not a sufficient amount of water present, it is necessary to return the same water to entrain more air until finally the pump lifts the water to itself. Unless you are willing to sacrifice capacity by letting the pump recirculate a portion of its water at all times, it is necessary to have some means to prevent the return of the water when such return is no longer necessary. Only the LaBour Self-Priming Pump accomplishes this without the use of valves.

There are two openings going outward from the casing of the LaBour Self-Priming Pump—shape, size and position of each of these openings has been the result of long experimentation. When the pump is priming, all of the water and air from the impeller blades is driven out of the first opening and into a separator from which the water, now of a single drop of water after prime has been established, This water again entrains air and the cycle repeats.

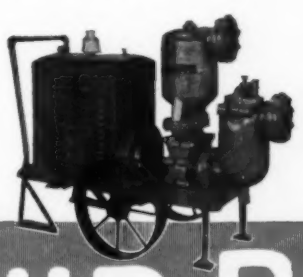
When the prime has been established there is too much water to pass out of the first opening, consequently the surplus will go out through the second opening. The mere fact that water is moving outward through this second opening prevents the return of any water which would otherwise come from the separator. There can be, therefore, no recirculation at any time after the air has been removed, and, the fact that water moves in both directions through the secondary opening, keeps it free from the piling up of sand or other particles which might otherwise take place. There are absolutely no valves to stick, to wear or to fail and thus hinder or arrest the operation of the pump.

PUMPING

In handling gritty or semi-solid substances in the water, there is always danger that a small piece of matter may stick in the valves and make the pump inoperative. With LaBour Pumps there are no valves of any kind, and, consequently, this danger is eliminated. Another advantage is that when the pump is turned off, all of the water in the line can immediately rush back and out at the intake, thus removing and dispersing matter which may be gathered around the screen. This makes for more effective and satisfactory pumping when the pump is again put in operation.

Only LaBour gives you these advantages.

This is the second of a series of advertisements which we shall endeavor to make a veritable primer of pumping. Reprints may be had for the asking.



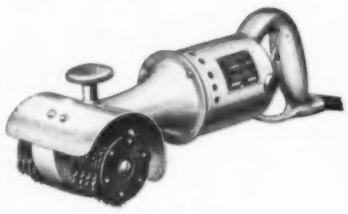
THE LABOUR CO., INC.
ELKHART, INDIANA

# LA BOUR PUMPS

NEVER LAY DOWN ON THE JOB

# A New Method for Cleaning Steel

A NEW tool which introduces a new method for removing paint, rust and scale from steel surfaces, has recently been announced by the Concrete Surfacing Machinery Co., 4557 Spring Grove Ave., Cincinnati, Ohio. With this Berg cleaning tool one man can quickly cover large areas and produce a clean, smooth surface ready to receive new paint.



*The New Berg Cleaning Tool*

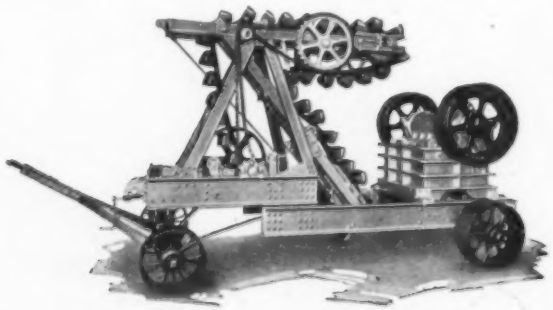
The machine is light, weighing only 8 pounds, and is easily operated. Two cutter bundles, each made up of 24 hardened steel 14-pointed cutters, are mounted on both sides of a gear housing. This set of cutters, totaling 48 in number, revolves at 2,000 rpm, causing the cutters to be thrown outward by centrifugal force and striking the surface 96,000 times per minute. The depth of the cutter contact is regulated by an easily adjusted depth shoe.

This tool is made in two models, electric and pneumatic. A General Electric Universal motor, for either 110 or 220 volts, is used on the electric model.

# A New Portable Crushing Plant

A PORTABLE crushing plant with bucket elevators, designed for easy transportation and equipped with truck wheels having roller bearings, extra wide treads and large diameters, has recently been developed by the Wheeling Mold & Foundry Co.. Wheeling, W. Va. The frame of this plant is extra heavy and consists of 12-inch channels. Directly under the crusher the frame is reinforced with double channels. The bucket line consists of heavy steel chains and heavy buckets with four take-up bearings, two at each end, to provide for adjusting. The bucket idlers are spaced for smooth operations, and the driving chain for the bucket line is provided with a suitable adjustable idler in order to take up any play in this drive chain.

The crusher in this plant is the Wheeling roller-bearing reduction crusher, which is designed with a forward movement of the movable jaw plate to avoid a tendency for rocker action. The use of roller bearings has made it possible to increase the speed of these crushers and therefore the capacity of the plant. By means of a hand winch and cable the head end of the elevator frame folds, and at the same time and with the same operation the foot end raises above the road travel. The hand winch can be quickly and easily operated by one man.

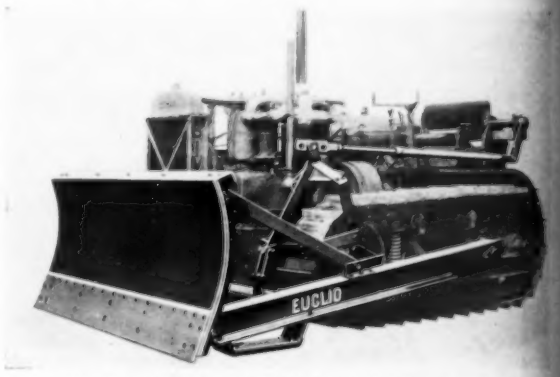


*The Wheeling Portable Crushing Plant*

# An Hydraulic Operated Bulldozer

ONE of the recent additions to the line of earth moving equipment manufactured by the Euclid Crane & Hoist Co., Road Machinery Division, Euclid, Ohio, is the Euclid hydraulic operated bulldozer. Light in weight yet strong, this bulldozer features a specially designed hydraulic pump and a lifting jack, which is small and compact, with plenty of surplus power, leaving the drawbar free for all uses.

This bulldozer, the control of which is within easy reach of the operator, is easily attached to or detached from the tractor, is evenly balanced and so constructed that it eliminates the necessity of a two-way jack yet permits the leveling operations necessary in many states.




*The New Bulldozer Which Is Hydraulic Operated*

# Creeper Wheel Trailers

WATSON creeper wheel trailers are made in both the semi-trailer and full-trailer types by the Rex-Watson Corp., Canastota, N. Y. The smaller size semi-trailer has a capacity of 5 yards without the grader board or 6 yards with the grader board. It is 10 feet 8¾ inches long inside at the top, 6 feet 8¾ inches wide and 3 feet 3 inches deep, the box body being 29 inches above the ground. The door opening is 4 feet wide and 8 feet long. The overall dimensions of the wheels are 72 x 33 inches, and the track width 18 inches. They have a capacity of 10 tons. The approximate total weight of this unit is 9,000 to 9,300 pounds.

The 7-yard creeper wheel semi-trailer is 12 feet 8¾ inches long inside at the top, 6 feet 8¾ inches wide and 3 feet 3 inches deep with other measurements in proportion. The creeper wheels on this model have a capacity of 15 tons and the approximate weight of the trailer is 10,000 to 10,500 pounds.

The full trailers are made in 5-yard, 8-yard and 10-yard capacities, weighing approximately 9,500, 15,300 and 17,000 pounds, respectively. The 10-yard model is 17 feet 2 inches long inside at the top, 6 feet 11 inches wide and 3 feet 7 deep with an overall height of 74 inches with side boards. The front disc wheels are 35 x 10 inches and the rear creeper wheels 74 x 35 inches with a track width of 20 inches and a capacity of 15 tons.

## Southwest Road Show and School

THE Sixth Annual Southwest Road Show and School will be held on February 24-27, 1931, at Wichita, Kan. The educational program will be arranged under the supervision of the Kansas State Highway Commission and the Kansas State Agricultural College in cooperation with the Highway Commissions of the Southwest States, the U. S. Bureau of Public Roads, colleges and universities. There will also be an exposition in connection with the school.

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